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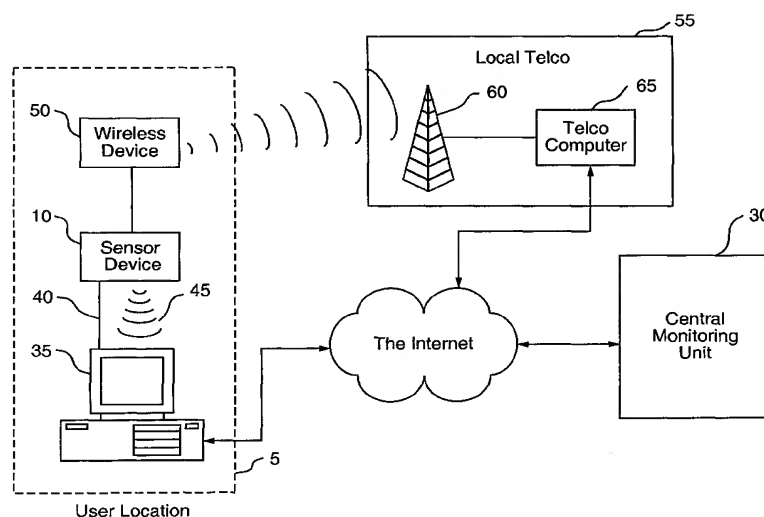
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(54) Title: SYSTEM FOR MONITORING HEALTH, WELLNESS AND FITNESS



(57) Abstract: A detecting, monitoring and reporting system includes a sensor device which generates data indicative of physiological parameters of an individual and data derived therefrom when placed in proximity with the body. A remote central monitoring unit generates analytical status data from the data indicative of physiological parameters, the derived data, and analytical status data that has previously been generated. A data storage device stores the data received and generated by the central monitoring unit. The system includes means for establishing electronic communication between the sensor device and the central monitoring unit, and means for transmitting the data to a recipient. The sensor device may also generate data indicative of contextual parameters of the individual, which may then be used when generating the analytical status data. The system may be used for monitoring and providing feedback relating to the degree to which an individual has followed a suggested routine.



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## **THE DESCRIPTION**

### **SYSTEM FOR MONITORING HEALTH, WELLNESS AND FITNESS**

#### **TECHNICAL FIELD**

The present invention relates to a system for monitoring health, wellness and fitness, and in particular, to a system for collecting and storing at a remote site data relating to an individual's physiological state, lifestyle, and various contextual parameters, and making such data and analytical information based on such data available to the individual, preferably over an electronic network.

#### **BACKGROUND ART**

Research has shown that a large number of the top health problems in society are either caused in whole or in part by an unhealthy lifestyle. More and more, our society requires people to lead fast-paced, achievement-oriented lifestyles that often result in poor eating habits, high stress levels, lack of exercise, poor sleep habits and the inability to find the time to center the mind and relax. Recognizing this fact, people are becoming increasingly interested in establishing a healthier lifestyle.

Traditional medicine, embodied in the form of an HMO or similar organizations, does not have the time, the training, or the reimbursement mechanism to address the needs of those individuals interested in a healthier lifestyle. There have been several attempts to meet the needs of these individuals, including a perfusion of fitness programs and exercise equipment, dietary plans, self-help books, alternative therapies, and most recently, a plethora of health information web sites on the Internet. Each of these attempts are targeted to empower the individual to take charge and get healthy. Each of these attempts, however, addresses only part of the needs of individuals seeking a healthier lifestyle and ignores many of the real barriers that most individuals face when trying to adopt a healthier lifestyle. These barriers include the fact that the individual is often left to himself or herself to find motivation, to implement a plan for achieving a healthier lifestyle, to monitor progress, and to brainstorm solutions when problems arise; the fact that existing programs are directed to only certain aspects of a healthier lifestyle, and rarely come as a complete package; and the fact that recommendations are often not targeted to the unique characteristics of the individual or his life circumstances.

DISCLOSURE OF INVENTION

A system is disclosed for detecting, monitoring and reporting human physiological information. The system includes a sensor device which generates at least one of data indicative of one or more physiological parameters and derived data from at least a portion of the data indicative of one or more physiological parameters when placed in proximity with at least a portion of the human body. The system also includes a central monitoring unit located remote from the sensor device. The central monitoring unit generates analytical status data from at least one of the data indicative of one or more physiological parameters, the derived data, and analytical status data that has previously been generated. The central monitoring unit also includes a data storage device for retrievably storing the data it receives and generates. The disclosed system also includes means for establishing electronic communication between the sensor device and the central monitoring unit. Examples may include various known types of long range wireless transmission devices, or a physical or a short range wireless coupling to a computer which in turn establishes electronic communication with the central monitoring unit over an electronic network such as the Internet. Also included in the system is a means for transmitting the data indicative of one or more physiological parameters, the derived data, and/or the analytical status data to a recipient, such as the individual or a third party authorized by the individual.

Also disclosed is a method of detecting, monitoring and reporting human physiological information. The method includes generating at least one of data indicative of one or more physiological parameters of an individual and derived data from at least a portion of the data indicative of one or more physiological parameters using a sensor device adapted to be placed in proximity with at least a portion of the human body. The at least one of the data indicative of one or more physiological parameters and the derived data are transmitted to a central monitoring unit remote from said sensor device and retrievably stored in a storage device. Analytical status data is generated from at least a portion of at least one of the data indicative of one or more physiological parameters, the derived data and the analytical status data, and at least one of the data indicative of one or more physiological parameters, the derived data and the analytical status data is transmitted to a recipient.

The sensor device includes one or more sensors for generating signals in response to physiological characteristics of the individual. The sensor device may also include a processor

that is adapted to generate the data indicative of one or more physiological parameters from the signals generated by the one or more sensors. The processor may also be adapted to generate the derived data. Alternatively, the derived data may be generated by the central monitoring unit.

The central monitoring unit may be adapted to generate one or more web pages  
5 containing the data indicative of one or more physiological parameters, the derived data, and/or the analytical status data. The web pages generated by the central monitoring unit are accessible by the recipient over an electronic network, such as the Internet. Alternatively, the data indicative of one or more physiological parameters, the derived data, and/or the analytical status data may be transmitted to the recipient in a physical form such as mail or facsimile.

10 The system and method may also obtain life activities data of the individual and may use such life activities data when generating the analytical status data. Furthermore, the sensor device may also be adapted to generate data indicative of one or more contextual parameters of the individual. The system and method may then use the data indicative of one or more contextual parameters when generating the analytical status data.

15 Also disclosed is a system for monitoring the degree to which an individual has followed a suggested routine. The system includes a sensor device adapted to generate at least one of data indicative of one or more physiological parameters of the individual and derived data from at least a portion of the data indicative of one or more physiological parameters when the sensor device is placed in proximity with at least a portion of the human body. Also included is a means  
20 for transmitting the data that is generated by the sensor device to a central monitoring unit remote from the sensor device and means for providing life activities data of the individual to the central monitoring unit. The central monitoring unit is adapted to generate and provide feedback to a recipient relating to the degree to which the individual has followed the suggested routine. The feedback is generated from at least a portion of at least one of the data indicative of one or more  
25 physiological parameters, the derived data, and the life activities data.

Also disclosed is a method of monitoring the degree to which an individual has followed a suggested routine. The method includes receiving, at a central monitoring unit, at least one of data indicative of one or more physiological parameters of said individual and derived data based on at least a portion of the data indicative of one or more physiological parameters, wherein the  
30 data indicative of one or more physiological parameters and the derived data are generated by a sensor device when placed in proximity with at least a portion of the human body. Also received at the central monitoring unit is life activities data of the individual. The method further includes

generating at the central monitoring unit feedback relating to the degree to which the individual has followed the suggested routine, the feedback being generated from at least a portion of at least one of the data indicative of one or more physiological parameters of the individual, the derived data, and the life activities data, and providing the feedback to a recipient.

5       The suggested routine may include a plurality of categories, wherein the feedback is generated and provided with respect to each of the categories. Examples of the categories include nutrition, activity level, mind centering, sleep, and daily activities. The feedback may be provided in graphical form and may be contained in one or more web pages generated by the central monitoring unit. Alternatively, the feedback may be transmitted to the recipient in a  
10       physical form.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Further features and advantages of the present invention will be apparent upon consideration of the following detailed description of the present invention, taken in conjunction  
15       with the following drawings, in which like reference characters refer to like parts, and in which:

Fig. 1 is a diagram of an embodiment of a system for monitoring physiological data and lifestyle over an electronic network according to the present invention;

Fig. 2 is a block diagram of an embodiment of the sensor device shown in Fig. 1;

Fig. 3 is a block diagram of an embodiment of the central monitoring unit shown  
20       in Fig. 1;

Fig. 4 is a block diagram of an alternate embodiment of the central monitoring unit shown in Fig. 1;

Fig. 5 is a representation of a preferred embodiment of the Health Manager web page according to an aspect of the present invention;

25       Fig. 6 is a representation of a preferred embodiment of the nutrition web page according to an aspect of the present invention;

Fig. 7 is a representation of a preferred embodiment of the activity level web page according to an aspect of the present invention;

Fig. 8 is a representation of a preferred embodiment of the mind centering web  
30       page according to an aspect of the present invention;

Fig. 9 is a representation of a preferred embodiment of the sleep web page according to an aspect of the present invention;

Fig. 10 is a representation of a preferred embodiment of the daily activities web page according to an aspect of the present invention; and

Fig. 11 is a representation of a preferred embodiment of the Health Index web page according to an aspect of the present invention.

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#### BEST MODE FOR CARRYING OUT THE INVENTION

In general, according to the present invention, data relating to the physiological state, the lifestyle and certain contextual parameters of an individual is collected and transmitted, either subsequently or in real-time, to a site, preferably remote from the individual, where it is stored  
10 for later manipulation and presentation to a recipient, preferably over an electronic network such as the Internet. Contextual parameters as used herein means parameters relating to the environment, surroundings and location of the individual, including, but not limited to, air quality, sound quality, ambient temperature, global positioning and the like. Referring to Fig.1, located at user location 5 is sensor device 10 adapted to be placed in proximity with at least  
15 portion of the human body. Sensor device 10 is preferably worn by an individual user on his or her body, for example as part of a garment such as a form fitting shirt, or as part of an arm band or the like. Sensor device 10, includes one or more sensors, which are adapted to generate signals in response to physiological characteristics of an individual, and a microprocessor. Proximity as used herein means that the sensors of sensor device 10 are separated from the  
20 individual's body by a material or the like, or a distance such that the capabilities of the sensors are not impeded.

Sensor device 10 generates data indicative of various physiological parameters of an individual, such as the individual's heart rate, pulse rate, beat-to-beat heart variability, EKG or ECG, respiration rate, skin temperature, core body temperature, heat flow off the body, galvanic  
25 skin response or GSR, EMG, EEG, EOG, blood pressure, body fat, hydration level, activity level, oxygen consumption, glucose or blood sugar level, body position, pressure on muscles or bones, and UV radiation absorption. In certain cases, the data indicative of the various physiological parameters is the signal or signals themselves generated by the one or more sensors and in certain other cases the data is calculated by the microprocessor based on the signal or signals generated  
30 by the one or more sensors. Methods for generating data indicative of various physiological parameters and sensors to be used therefor are well known. Table 1 provides several examples of

such well known methods and shows the parameter in question, the method used, the sensor device used, and the signal that is generated. Table 1 also provides an indication as to whether further processing based on the generated signal is required to generate the data.

5

**Table 1**

| <b>Parameter</b>         | <b>Method</b>              | <b>Sensor</b>                  | <b>Signal</b>        | <b>Further Processing</b> |
|--------------------------|----------------------------|--------------------------------|----------------------|---------------------------|
| Heart Rate               | EKG                        | 2 Electrodes                   | DC Voltage           | Yes                       |
| Pulse Rate               | BVP                        | LED Emitter and Optical Sensor | Change in Resistance | Yes                       |
| Beat-to-Beat Variability | Heart Rate                 | 2 Electrodes                   | DC Voltage           | Yes                       |
| EKG                      | Skin Surface Potentials    | 3-10 Electrodes                | DC Voltage           | No                        |
| Respiration Rate         | Chest Volume Change        | Strain Gauge                   | Change in Resistance | Yes                       |
| Skin Temperature         | Surface Temperature Probe  | Thermistors                    | Change in Resistance | Yes                       |
| Core Temperature         | Esophageal or Rectal Probe | Thermistors                    | Change in Resistance | Yes                       |

| Parameter                                   | Method                        | Sensor                          | Signal                          | Further Processing |
|---|-------------------------------|---------------------------------|---------------------------------|--------------------|
| Heat Flow                                   | Heat Flux                     | Thermopile                      | DC Voltage                      | Yes                |
| Galvanic Skin Response                      | Skin Conductance              | 2 Electrodes                    | Change in Resistance            | No                 |
| EMG   | Skin Surface Potentials       | 3 Electrodes                    | DC Voltage                      | No                 |
| EEG   | Skin Surface Potentials       | Multiple Electrodes             | DC Voltage                      | Yes                |
| EOG   | Eye Movement                  | Thin Film Piezoelectric Sensors | DC Voltage                      | Yes                |
| Blood Pressure                              | Non-Invasive Korotkuff Sounds | Electronic Sphygmomanometer     | Change in Resistance            | Yes                |
| Body Fat                                    | Body Impedance                | 2 Active Electrodes             | Change in Impedance             | Yes                |
| Activity in Interpreted G Shocks per Minute | Body Movement                 | Accelerometer                   | DC Voltage, Capacitance Changes | Yes                |

| Parameter                                      | Method        | Sensor                          | Signal            | Further Processing |
|--|---------------|---------------------------------|-------------------|--------------------|
| Oxygen Consumption                             | Oxygen Uptake | Electro-chemical                | DC Voltage Change | Yes                |
| Glucose Level                                  | Non-Invasive  | Electro-chemical                | DC Voltage Change | Yes                |
| Body Position<br>(e.g. supine, erect, sitting) | N/A           | Mercury Switch Array            | DC Voltage Change | Yes                |
| Muscle Pressure                                | N/A           | Thin Film Piezoelectric Sensors | DC Voltage Change | Yes                |
| UV Radiation Absorption                        | N/A           | UV Sensitive Photo Cells        | DC Voltage Change | Yes                |

The types of data listed in Table 1 are intended to be examples of the types of data that can be generated by sensor device 10. It is to be understood that other types of data relating to other parameters can be generated by sensor device 10 without departing from the scope of the present invention.

The microprocessor of sensor device 10 may be programmed to summarize and analyze the data. For example, the microprocessor can be programmed to calculate an average, minimum or maximum heart rate or respiration rate over a defined period of time, such as ten minutes. Sensor device 10 may be able to derive information relating to an individual's physiological state based on the data indicative of one or more physiological parameters. The microprocessor of sensor device 10 is programmed to derive such information using known methods based on the data indicative of one or more physiological parameters. Table 2 provides examples of the type

of information that can be derived, and indicates some of the types of data that can be used therefor.

**Table 2**

| Derived Information  | Data Used  |
|----------------------|--|
| Ovulation            | Skin temperature, core temperature, oxygen consumption   |
| Sleep onset/wake     | Beat-to-beat variability, heart rate, pulse rate, respiration rate, skin temperature, core temperature, heat flow, galvanic skin response, EMG, EEG, EOG, blood pressure, oxygen consumption |
| Calories burned      | Heart rate, pulse rate, respiration rate, heat flow, activity, oxygen consumption  |
| Basal metabolic rate | Heart rate, pulse rate, respiration rate, heat flow, activity, oxygen consumption  |
| Basal temperature    | Skin temperature, core temperature   |
| Activity level       | Heart rate, pulse rate, respiration rate, heat flow, activity, oxygen consumption  |
| Stress level         | EKG, beat-to-beat variability, heart rate, pulse rate, respiration rate, skin temperature, heat flow, galvanic skin response, EMG, EEG, blood pressure, activity, oxygen consumption         |
| Relaxation level     | EKG, beat-to-beat variability, heart rate, pulse rate, respiration rate, skin temperature, heat flow, galvanic skin response, EMG, EEG, blood pressure, activity, oxygen consumption         |

| Derived Information  | Data Used  |
|--|--|
| Maximum oxygen consumption rate  | EKG, heart rate, pulse rate, respiration rate, heat flow, blood pressure, activity, oxygen consumption |
| Rise time or the time it takes to rise from a resting rate to 85% of a target maximum  | Heart rate, pulse rate, heat flow, oxygen consumption  |
| Time in zone or the time heart rate was above 85% of a target maximum  | Heart rate, pulse rate, heat flow, oxygen consumption  |
| Recovery time or the time it takes heart rate to return to a resting rate after heart rate was above 85% of a target maximum | Heart rate, pulse rate, heat flow, oxygen consumption  |

Additionally, sensor device 10 may also generate data indicative of various contextual parameters relating to the environment surrounding the individual. For example, sensor device 10 can generate data indicative of the air quality, sound level/quality, light quality or ambient temperature near the individual, or even the global positioning of the individual. Sensor device 10 may include one or more sensors for generating signals in response to contextual characteristics relating to the environment surrounding the individual, the signals ultimately being used to generate the type of data described above. Such sensors are well known, as are methods for generating contextual parametric data such as air quality, sound level/quality, ambient temperature and global positioning.

Fig. 2 is a block diagram of an embodiment of sensor device 10. Sensor device 10 includes at least one sensor 12 and microprocessor 20. Depending upon the nature of the signal generated by sensor 12, the signal can be sent through one or more of amplifier 14, conditioning circuit 16, and analog-to-digital converter 18, before being sent to microprocessor 20. For

example, where sensor 12 generates an analog signal in need of amplification and filtering, that signal can be sent to amplifier 14, and then on to conditioning circuit 16, which may, for example, be a band pass filter. The amplified and conditioned analog signal can then be transferred to analog-to-digital converter 18, where it is converted to a digital signal. The digital  
5 signal is then sent to microprocessor 20. Alternatively, if sensor 12 generates a digital signal, that signal can be sent directly to microprocessor 20.

A digital signal or signals representing certain physiological and/or contextual characteristics of the individual user may be used by microprocessor 20 to calculate or generate data indicative of physiological and/or contextual parameters of the individual user.  
10 Microprocessor 20 is programmed to derive information relating to at least one aspect of the individual's physiological state. It should be understood that microprocessor 20 may also comprise other forms of processors or processing devices, such as a microcontroller, or any other device that can be programmed to perform the functionality described herein.

The data indicative of physiological and/or contextual parameters can, according to one  
15 embodiment of the present invention, be sent to memory 22, such as flash memory, where it is stored until uploaded in the manner to be described below. Although memory 22 is shown in Fig. 2 as a discrete element, it will be appreciated that it may also be part of microprocessor 20. Sensor device 10 also includes input/output circuitry 24, which is adapted to output and receive as input certain data signals in the manners to be described herein. Thus, memory 22 of the  
20 sensor device 10 will build up, over time, a store of data relating to the individual user's body and/or environment. That data is periodically uploaded from sensor device 10 and sent to remote central monitoring unit 30, as shown in Fig. 1, where it is stored in a database for subsequent processing and presentation to the user, preferably through a local or global electronic network such as the Internet. This uploading of data can be an automatic process that is initiated by  
25 sensor device 10 periodically or upon the happening of an event such as the detection by sensor device 10 of a heart rate below a certain level, or can be initiated by the individual user or some third party authorized by the user, preferably according to some periodic schedule, such as every day at 10:00 p.m. Alternatively, rather than storing data in memory 22, sensor device 10 may continuously upload data in real time.

30 The uploading of data from sensor device 10 to central monitoring unit 30 for storage can be accomplished in various ways. In one embodiment, the data collected by sensor device 10 is uploaded by first transferring the data to personal computer 35 shown in Fig. 1 by means of

physical connection 40, which, for example, may be a serial connection such as an RS232 or USB port. This physical connection may also be accomplished by using a cradle, not shown, that is electronically coupled to personal computer 35 into which sensor device 10 can be inserted, as is common with many commercially available personal digital assistants. The uploading of data could be initiated by then pressing a button on the cradle or could be initiated automatically upon insertion of sensor device 10. The data collected by sensor device 10 may be uploaded by first transferring the data to personal computer 35 by means of short-range wireless transmission, such as infrared or radio transmission, as indicated at 45.

Once the data is received by personal computer 35, it is optionally compressed and encrypted by any one of a variety of well known methods and then sent out over a local or global electronic network, preferably the Internet, to central monitoring unit 30. It should be noted that personal computer 35 can be replaced by any computing device that has access to and that can transmit and receive data through the electronic network, such as, for example, a personal digital assistant such as the Palm VII sold by Palm, Inc., or the Blackberry 2-way pager sold by Research in Motion, Inc.

Alternatively, the data collected by sensor device 10, after being encrypted and, optionally, compressed by microprocessor 20, may be transferred to wireless device 50, such as a 2-way pager or cellular phone, for subsequent long distance wireless transmission to local telco site 55 using a wireless protocol such as e-mail or as ASCII or binary data. Local telco site 55 includes tower 60 that receives the wireless transmission from wireless device 50 and computer 65 connected to tower 60. According to the preferred embodiment, computer 65 has access to the relevant electronic network, such as the Internet, and is used to transmit the data received in the form of the wireless transmission to the central monitoring unit 30 over the Internet. Although wireless device 50 is shown in Fig. 1 as a discrete device coupled to sensor device 10, it or a device having the same or similar functionality may be embedded as part of sensor device 10.

Sensor device 10 may be provided with a button to be used to time stamp events such as time to bed, wake time, and time of meals. These time stamps are stored in sensor device 10 and are uploaded to central monitoring unit 30 with the rest of the data as described above. The time stamps may include a digitally recorded voice message that, after being uploaded to central monitoring unit 30, are translated using voice recognition technology into text or some other information format that can be used by central monitoring unit 30.

In addition to using sensor device 10 to automatically collect physiological data relating to an individual user, a kiosk could be adapted to collect such data by, for example, weighing the individual, providing a sensing device similar to sensor device 10 on which an individual places his or her hand or another part of his or her body, or by scanning the individual's body using, for example, laser technology or an iStat blood analyzer. The kiosk would be provided with processing capability as described herein and access to the relevant electronic network, and would thus be adapted to send the collected data to the central monitoring unit 30 through the electronic network. A desktop sensing device, again similar to sensor device 10, on which an individual places his or her hand or another part of his or her body may also be provided. For example, such a desktop sensing device could be a blood pressure monitor in which an individual places his or her arm. An individual might also wear a ring having a sensor device 10 incorporated therein. A base, not shown, could then be provided which is adapted to be coupled to the ring. The desktop sensing device or the base just described may then be coupled to a computer such as personal computer 35 by means of a physical or short range wireless connection so that the collected data could be uploaded to central monitoring unit 30 over the relative electronic network in the manner described above. A mobile device such as, for example, a personal digital assistant, might also be provided with a sensor device 10 incorporated therein. Such a sensor device 10 would be adapted to collect data when mobile device is placed in proximity with the individual's body, such as by holding the device in the palm of one's hand, and upload the collected data to central monitoring unit 30 in any of the ways described herein.

Furthermore, in addition to collecting data by automatically sensing such data in the manners described above, individuals can also manually provide data relating to various life activities that is ultimately transferred to and stored at central monitoring unit 30. An individual user can access a web site maintained by central monitoring unit 30 and can directly input information relating to life activities by entering text freely, by responding to questions posed by the web site, or by clicking through dialog boxes provided by the web site. Central monitoring unit 30 can also be adapted to periodically send electronic mail messages containing questions designed to elicit information relating to life activities to personal computer 35 or to some other device that can receive electronic mail, such as a personal digital assistant, a pager, or a cellular phone. The individual would then provide data relating to life activities to central monitoring unit 30 by responding to the appropriate electronic mail message with the relevant data. Central monitoring unit 30 may also be adapted to place a telephone call to an individual user in which

certain questions would be posed to the individual user. The user could respond to the questions by entering information using a telephone keypad, or by voice, in which case conventional voice recognition technology would be used by central monitoring unit 30 to receive and process the response. The telephone call may also be initiated by the user, in which case the user could  
5 speak to a person directly or enter information using the keypad or by voice/voice recognition technology. Central monitoring unit 30 may also be given access to a source of information controlled by the user, for example the user's electronic calendar such as that provided with the Outlook product sold by Microsoft Corporation of Redmond, Washington, from which it could automatically collect information. The data relating to life activities may relate to the eating,  
10 sleep, exercise, mind centering or relaxation, and/or daily living habits, patterns and/or activities of the individual. Thus, sample questions may include: What did you have for lunch today? What time did you go to sleep last night? What time did you wake up this morning? How long did you run on the treadmill today?

Feedback may also be provided to a user directly through sensor device 10 in a visual  
15 form, for example through an LED or LCD or by constructing sensor device 10, at least in part, of a thermochromatic plastic, in the form of an acoustic signal or in the form of tactile feedback such as vibration. Such feedback may be a reminder or an alert to eat a meal or take medication or a supplement such as a vitamin, to engage in an activity such as exercise or meditation, or to drink water when a state of dehydration is detected. Additionally, a reminder or alert can be  
20 issued in the event that a particular physiological parameter such as ovulation has been detected, a level of calories burned during a workout has been achieved or a high heart rate or respiration rate has been encountered.

As will be apparent to those of skill in the art, it may be possible to "download" data from central monitoring unit 30 to sensor device 10. The flow of data in such a download process  
25 would be substantially the reverse of that described above with respect to the upload of data from sensor device 10. Thus, it is possible that the firmware of microprocessor 20 of sensor device 10 can be updated or altered remotely, i.e., the microprocessor can be reprogrammed, by downloading new firmware to sensor device 10 from central monitoring unit 30 for such parameters as timing and sample rates of sensor device 10. Also, the reminders/alerts provided  
30 by sensor device 10 may be set by the user using the web site maintained by central monitoring unit 30 and subsequently downloaded to the sensor device 10.

Referring to Fig. 3, a block diagram of an embodiment of central monitoring unit 30 is shown. Central monitoring unit 30 includes CSU/DSU 70 which is connected to router 75, the main function of which is to take data requests or traffic, both incoming and outgoing, and direct such requests and traffic for processing or viewing on the web site maintained by central monitoring unit 30. Connected to router 75 is firewall 80. The main purpose of firewall 80 is to protect the remainder of central monitoring unit 30 from unauthorized or malicious intrusions. Switch 85, connected to firewall 80, is used to direct data flow between middleware servers 95a through 95c and database server 110. Load balancer 90 is provided to spread the workload of incoming requests among the identically configured middleware servers 95a through 95c. Load balancer 90, a suitable example of which is the F5 ServerIron product sold by Foundry Networks, Inc. of San Jose, California, analyzes the availability of each middleware server 95a through 95c, and the amount of system resources being used in each middleware server 95a through 95c, in order to spread tasks among them appropriately.

Central monitoring unit 30 includes network storage device 100, such as a storage area network or SAN, which acts as the central repository for data. In particular, network storage device 100 comprises a database that stores all data gathered for each individual user in the manners described above. An example of a suitable network storage device 100 is the Symmetrix product sold by EMC Corporation of Hopkinton, Massachusetts. Although only one network storage device 100 is shown in Fig. 3, it will be understood that multiple network storage devices of various capacities could be used depending on the data storage needs of central monitoring unit 30. Central monitoring unit 30 also includes database server 110 which is coupled to network storage device 100. Database server 110 is made up of two main components: a large scale multiprocessor server and an enterprise type software server component such as the 8/8i component sold by Oracle Corporation of Redwood City, California, or the 506 7 component sold by Microsoft Corporation of Redmond, Washington. The primary functions of database server 110 are that of providing access upon request to the data stored in network storage device 100, and populating network storage device 100 with new data. Coupled to network storage device 100 is controller 115, which typically comprises a desktop personal computer, for managing the data stored in network storage device 100.

Middleware servers 95a through 95c, a suitable example of which is the 22OR Dual Processor sold by Sun Microsystems, Inc. of Palo Alto, California, each contain software for generating and maintaining the corporate or home web page or pages of the web site maintained

by central monitoring unit 30. As is known in the art, a web page refers to a block or blocks of data available on the World-Wide Web comprising a file or files written in Hypertext Markup Language or HTML, and a web site commonly refers to any computer on the Internet running a World-Wide Web server process. The corporate or home web page or pages are the opening or landing web page or pages that are accessible by all members of the general public that visit the site by using the appropriate uniform resource locator or URL. As is known in the art, URLs are the form of address used on the World-Wide Web and provide a standard way of specifying the location of an object, typically a web page, on the Internet. Middleware servers 95a through 95c also each contain software for generating and maintaining the web pages of the web site of central monitoring unit 30 that can only be accessed by individuals that register and become members of central monitoring unit 30. The member users will be those individuals who wish to have their data stored at central monitoring unit 30. Access by such member users is controlled using passwords for security purposes. Preferred embodiments of those web pages are described in detail below and are generated using collected data that is stored in the database of network storage device 100.

Middleware servers 95a through 95c also contain software for requesting data from and writing data to network storage device 100 through database server 110. When an individual user desires to initiate a session with the central monitoring unit 30 for the purpose of entering data into the database of network storage device 100, viewing his or her data stored in the database of network storage device 100, or both, the user visits the home web page of central monitoring unit 30 using a browser program such as Internet Explorer distributed by Microsoft Corporation of Redmond, Washington, and logs in as a registered user. Load balancer 90 assigns the user to one of the middleware servers 95a through 95c, identified as the chosen middleware server. A user will preferably be assigned to a chosen middleware server for each entire session. The chosen middleware server authenticates the user using any one of many well known methods, to ensure that only the true user is permitted to access the information in the database. A member user may also grant access to his or her data to a third party such as a health care provider or a personal trainer. Each authorized third party may be given a separate password and may view the member user's data using a conventional browser. It is therefore possible for both the user and the third party to be the recipient of the data.

When the user is authenticated, the chosen middleware server requests, through database server 110, the individual user's data from network storage device 100 for a predetermined time

period. The predetermined time period is preferably thirty days. The requested data, once received from network storage device 100, is temporarily stored by the chosen middleware server in cache memory. The cached data is used by the chosen middleware server as the basis for presenting information, in the form of web pages, to the user again through the user's browser.

5 Each middleware server 95a through 95c is provided with appropriate software for generating such web pages, including software for manipulating and performing calculations utilizing the data to put the data in appropriate format for presentation to the user. Once the user ends his or her session, the data is discarded from cache. When the user initiates a new session, the process for obtaining and caching data for that user as described above is repeated. This caching system

10 thus ideally requires that only one call to the network storage device 100 be made per session, thereby reducing the traffic that database server 110 must handle. Should a request from a user during a particular session require data that is outside of a predetermined time period of cached data already retrieved, a separate call to network storage device 100 may be performed by the chosen middleware server. The predetermined time period should be chosen, however, such that

15 such additional calls are minimized. Cached data may also be saved in cache memory so that it can be reused when a user starts a new session, thus eliminating the need to initiate a new call to network storage device 100.

As described in connection with Table 2, the microprocessor of sensor device 10 may be programmed to derive information relating to an individual's physiological state based on the

20 data indicative of one or more physiological parameters. Central monitoring unit 30, and preferably middleware servers 95a through 95c, may also be similarly programmed to derive such information based on the data indicative of one or more physiological parameters.

It is also contemplated that a user will input additional data during a session, for example, information relating to the user's eating or sleeping habits. This additional data is preferably

25 stored by the chosen middleware server in a cache during the duration of the user's session. When the user ends the session, this additional new data stored in a cache is transferred by the chosen middleware server to database server 110 for population in network storage device 100. Alternatively, in addition to being stored in a cache for potential use during a session, the input data may also be immediately transferred to database server 110 for population in network

30 storage device 100, as part of a write-through cache system which is well known in the art.

Data collected by sensor device 10 shown in Fig. 1 is periodically uploaded to central monitoring unit 30. Either by long distance wireless transmission or through personal computer

35, a connection to central monitoring unit 30 is made through an electronic network, preferably the Internet. In particular, connection is made to load balancer 90 through CSU/DSU 70, router 75, firewall 80 and switch 85. Load balancer 90 then chooses one of the middleware servers 95a through 95c to handle the upload of data, hereafter called the chosen middleware server. The  
5 chosen middleware server authenticates the user using any one of many well known methods. If authentication is successful, the data is uploaded to the chosen middleware server as described above, and is ultimately transferred to database server 110 for population in the network storage device 100.

Referring to Fig. 4, an alternate embodiment of central monitoring unit 30 is shown. In  
10 addition to the elements shown and described with respect to Fig. 3, the embodiment of the central monitoring unit 30 shown in Fig. 4 includes a mirror network storage device 120 which is a redundant backup of network storage device 100. Coupled to mirror network storage device 120 is controller 122. Data from network storage device 100 is periodically copied to mirror network storage device 120 for data redundancy purposes.

15 Third parties such as insurance companies or research institutions may be given access, possibly for a fee, to certain of the information stored in mirror network storage device 120. Preferably, in order to maintain the confidentiality of the individual users who supply data to central monitoring unit 30, these third parties are not given access to such user's individual database records, but rather are only given access to the data stored in mirror network storage  
20 device 120 in aggregate form. Such third parties may be able to access the information stored in mirror network storage device 120 through the Internet using a conventional browser program. Requests from third parties may come in through CSU/DSU 70, router 75, firewall 80 and switch 85. In the embodiment shown in Fig. 4, a separate load balancer 130 is provided for spreading tasks relating to the accessing and presentation of data from mirror drive array 120 among  
25 identically configured middleware servers 135a through 135c. Middleware servers 135a through 135c each contain software for enabling the third parties to, using a browser, formulate queries for information from mirror network storage device 120 through separate database server 125. Middleware servers 135a through 135c also contain software for presenting the information obtained from mirror network storage device 120 to the third parties over the Internet in the form  
30 of web pages. In addition, the third parties can choose from a series of prepared reports that have information packaged along subject matter lines, such as various demographic categories.

As will be apparent to one of skill in the art, instead of giving these third parties access to the backup data stored in mirror network storage device 120, the third parties may be given access to the data stored in network storage device 100. Also, instead of providing load balancer 130 and middleware servers 135a through 135c, the same functionality, although at a sacrificed level of performance, could be provided by load balancer 90 and middleware servers 95a through 95c.

When an individual user first becomes a registered user or member, that user completes a detailed survey. The purposes of the survey are to: identify unique characteristics/circumstances for each user that they might need to address in order to maximize the likelihood that they will implement and maintain a healthy lifestyle as suggested by central monitoring unit 30; gather baseline data which will be used to set initial goals for the individual user and facilitate the calculation and display of certain graphical data output such as the Health Index pistons; identify unique user characteristics and circumstances that will help central monitoring unit 30 customize the type of content provided to the user in the Health Manager's Daily Dose; and identify unique user characteristics and circumstances that the Health Manager can guide the user to address as possible barriers to a healthy lifestyle through the problem-solving function of the Health Manager.

The specific information to be surveyed may include: key individual temperamental characteristics, including activity level, regularity of eating, sleeping, and bowel habits, initial response to situations, adaptability, persistence, threshold of responsiveness, intensity of reaction, and quality of mood; the user's level of independent functioning, i.e., self-organization and management, socialization, memory, and academic achievement skills; the user's ability to focus and sustain attention, including the user's level of arousal, cognitive tempo, ability to filter distractions, vigilance, and self-monitoring; the user's current health status including current weight, height, and blood pressure, most recent general physician visit, gynecological exam, and other applicable physician/healthcare contacts, current medications and supplements, allergies, and a review of current symptoms and/or health-related behaviors; the user's past health history, i.e., illnesses/surgeries, family history, and social stress events, such as divorce or loss of a job, that have required adjustment by the individual; the user's beliefs, values and opinions about health priorities, their ability to alter their behavior and, what might contribute to stress in their life, and how they manage it; the user's degree of self-awareness, empathy, empowerment, and self-esteem, and the user's current daily routines for eating, sleeping, exercise, relaxation and

completing activities of daily living; and the user's perception of the temperamental characteristics of two key persons in their life, for example, their spouse, a friend, a co-worker, or their boss, and whether there are clashes present in their relationships that might interfere with a healthy lifestyle or contribute to stress.

5        Each member user will have access, through the home web page of central monitoring unit 30, to a series of web pages customized for that user, referred to as the Health Manager. The opening Health Manager web page 150 is shown in Fig. 5. The Health Manager web pages are the main workspace area for the member user. The Health Manager web pages comprise a utility through which central monitoring unit 30 provides various types and forms of data, commonly  
10        referred to as analytical status data, to the user that is generated from the data it collects or generates, namely one or more of: the data indicative of various physiological parameters generated by sensor device 10; the data derived from the data indicative of various physiological parameters; the data indicative of various contextual parameters generated by sensor device 10; and the data input by the user. Analytical status data is characterized by the application of  
15        certain utilities or algorithms to convert one or more of the data indicative of various physiological parameters generated by sensor device 10, the data derived from the data indicative of various physiological parameters, the data indicative of various contextual parameters generated by sensor device 10, and the data input by the user into calculated health, wellness and  
20        lifestyle indicators. For example, based on data input by the user relating to the foods he or she has eaten, things such as calories and amounts of proteins, fats, carbohydrates, and certain vitamins can be calculated. As another example, skin temperature, heart rate, respiration rate, heat flow and/or GSR can be used to provide an indicator to the user of his or her stress level over a desired time period. As still another example, skin temperature, heat flow, beat-to-beat heart variability, heart rate, pulse rate, respiration rate, core temperature, galvanic skin response,  
25        EMG, EEG, EOG, blood pressure, oxygen consumption, ambient sound and body movement or motion as detected by a device such as an accelerometer can be used to provide indicators to the user of his or her sleep patterns over a desired time period.

      Located on the opening Health Manager web page 150 is Health Index 155. Health Index 155 is a graphical utility used to measure and provide feedback to member users regarding their  
30        performance and the degree to which they have succeeded in reaching a healthy daily routine suggested by central monitoring unit 30. Health Index 155 thus provides an indication for the member user to track his or her progress. Health Index 155 includes six categories relating to the

user's health and lifestyle: Nutrition, Activity Level, Mind Centering, Sleep, Daily Activities and How You Feel. The Nutrition category relates to what, when and how much a person eats and drinks. The Activity Level category relates to how much a person moves around. The Mind Centering category relates to the quality and quantity of time a person spends engaging in some activity that allows the body to achieve a state of profound relaxation while the mind becomes highly alert and focused. The Sleep category relates to the quality and quantity of a person's sleep. The Daily Activities category relates to the daily responsibilities and health risks people encounter. Finally, the How You Feel category relates to the general perception that a person has about how they feel on a particular day. Each category has an associated level indicator or piston that indicates, preferably on a scale ranging from poor to excellent, how the user is performing with respect to that category.

When each member user completes the initial survey described above, a profile is generated that provides the user with a summary of his or her relevant characteristics and life circumstances. A plan and/or set of goals is provided in the form of a suggested healthy daily routine. The suggested healthy daily routine may include any combination of specific suggestions for incorporating proper nutrition, exercise, mind centering, sleep, and selected activities of daily living in the user's life. Prototype schedules may be offered as guides for how these suggested activities can be incorporated into the user's life. The user may periodically retake the survey, and based on the results, the items discussed above will be adjusted accordingly.

The Nutrition category is calculated from both data input by the user and sensed by sensor device 10. The data input by the user comprises the time and duration of breakfast, lunch, dinner and any snacks, and the foods eaten, the supplements such as vitamins that are taken, and the water and other liquids consumed during a relevant, pre-selected time period. Based upon this data and on stored data relating to known properties of various foods, central monitoring unit 30 calculates well known nutritional food values such as calories and amounts of proteins, fats, carbohydrates, vitamins, etc., consumed.

The Nutrition Health Index piston level is preferably determined with respect to the following suggested healthy daily routine: eat at least three meals; eat a varied diet consisting of 6 – 11 servings of bread, pasta, cereal, and rice, 2 – 4 servings fruit, 3 – 5 servings of vegetables, 2 – 3 servings of fish, meat, poultry, dry beans, eggs, and nuts, and 2 – 3 servings of milk, yogurt and cheese; and drink 8 or more 8 ounce glasses of water. This routine may be adjusted based on

information about the user, such as sex, age, height and/or weight. Certain nutritional targets may also be set by the user or for the user, relating to daily calories, protein, fiber, fat, carbohydrates, and/or water consumption and percentages of total consumption. Parameters utilized in the calculation of the relevant piston level include the number of meals per day, the number of glasses of water, and the types and amounts of food eaten each day as input by the user.

Nutritional information is presented to the user through nutrition web page 160 as shown in Fig. 6. The preferred nutritional web page 160 includes nutritional fact charts 165 and 170 which illustrate actual and target nutritional facts, respectively as pie charts, and nutritional intake charts 175 and 180 which show total actual nutritional intake and target nutritional intake, respectively as pie charts. Nutritional fact charts 165 and 170 preferably show a percentage breakdown of items such as carbohydrates, protein and fat, and nutritional intake charts 175 and 180 are preferably broken down to show components such as total and target calories, fat, carbohydrates, protein, and vitamins. Web page 160 also includes meal and water consumption tracking 185 with time entries, hyperlinks 190 which allow the user to directly access nutrition-related news items and articles, suggestions for refining or improving daily routine with respect to nutrition and affiliate advertising elsewhere on the network, and calendar 195 for choosing between views having variable and selectable time periods. The items shown at 190 may be selected and customized based on information learned about the individual in the survey and on their performance as measured by the Health Index.

The Activity Level category of Health Index 155 is designed to help users monitor how and when they move around during the day and utilizes both data input by the user and data sensed by sensor device 10. The data input by the user may include details regarding the user's daily activities, for example the fact that the user worked at a desk from 8 a.m. to 5 p.m. and then took an aerobics class from 6 p.m. to 7 p.m. Relevant data sensed by sensor device 10 may include heart rate, movement as sensed by a device such as an accelerometer, heat flow, respiration rate, calories burned, GSR and hydration level, which may be derived by sensor device 60 or central monitoring unit 30. Calories burned may be calculated in a variety of manners, including: the multiplication of the type of exercise input by the user by the duration of exercise input by the user; sensed motion multiplied by time of motion multiplied by a filter constant; or sensed heat flux multiplied by time multiplied by a filter constant.

The Activity Level Health Index piston level is preferably determined with respect to a suggested healthy daily routine that includes: exercising aerobically for a pre-set time period, preferably 20 minutes, or engaging in a vigorous lifestyle activity for a pre-set time period, preferably one hour, and burning at least a minimum target number of calories, preferably 205 calories, through the aerobic exercise and/or lifestyle activity. The minimum target number of calories may be set according to information about the user, such as sex, age, height and/or weight. Parameters utilized in the calculation of the relevant piston level include the amount of time spent exercising aerobically or engaging in a vigorous lifestyle activity as input by the user and/or sensed by sensor device 10, and the number of calories burned above pre-calculated energy expenditure parameters.

Information regarding the individual user's movement is presented to the user through activity level web page 200 shown in Fig. 7, which may include activity graph 205 in the form of a bar graph, for monitoring the individual user's activities in one of three categories: high, medium and low intensity with respect to a pre-selected unit of time. Activity percentage chart 210, in the form of a pie chart, may also be provided for showing the percentage of a pre-selected time period, such as one day, that the user spent in each category. Activity level web page 200 may also include calorie section 215 for displaying items such as total calories burned, daily target calories burned, total caloric intake, and duration of aerobic activity. Finally, activity level web page 200 may include at least one hyperlink 220 to allow a user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to activity level and affiliate advertising elsewhere on the network. Activity level web page 200 may be viewed in a variety of formats, and may include user-selectable graphs and charts such as a bar graph, pie chart, or both, as selectable by Activity level check boxes 225. Activity level calendar 230 is provided for selecting among views having variable and selectable time periods. The items shown at 220 may be selected and customized based on information learned about the individual in the survey and on their performance as measured by the Health Index.

The Mind Centering category of Health Index 155 is designed to help users monitor the parameters relating to time spent engaging in certain activities which allow the body to achieve a state of profound relaxation while the mind becomes focused, and is based upon both data input by the user and data sensed by the sensor device 10. In particular, a user may input the beginning and end times of relaxation activities such as yoga or meditation. The quality of those activities as determined by the depth of a mind centering event can be measured by monitoring parameters

including skin temperature, heart rate, respiration rate, and heat flow as sensed by sensor device 10. Percent change in GSR as derived either by sensor device 10 or central monitoring unit 30 may also be utilized.

5 The Mind Centering Health Index piston level is preferably calculated with respect to a suggested healthy daily routine that includes participating each day in an activity that allows the body to achieve profound relaxation while the mind stays highly focused for at least fifteen minutes. Parameters utilized in the calculation of the relevant piston level include the amount of time spent in a mind centering activity, and the percent change in skin temperature, heart rate, respiration rate, heat flow or GSR as sensed by sensor device 10 compared to a baseline which is  
10 an indication of the depth or quality of the mind centering activity.

Information regarding the time spent on self-reflection and relaxation is presented to the user through mind centering web page 250 shown in Fig. 8. For each mind centering activity, referred to as a session, the preferred mind centering web page 250 includes the time spent during the session, shown at 255, the target time, shown at 260, comparison section 265 showing  
15 target and actual depth of mind centering, or focus, and a histogram 270 that shows the overall level of stress derived from such things as skin temperature, heart rate, respiration rate, heat flow and/or GSR. In comparison section 265, the human figure outline showing target focus is solid, and the human figure outline showing actual focus ranges from fuzzy to solid depending on the level of focus. The preferred mind centering web page may also include an indication of the total  
20 time spent on mind centering activities, shown at 275, hyperlinks 280 which allow the user to directly access relevant news items and articles, suggestions for refining or improving daily routine with respect to mind centering and affiliate advertising, and a calendar 285 for choosing among views having variable and selectable time periods. The items shown at 280 may be selected and customized based on information learned about the individual in the survey and on  
25 their performance as measured by the Health Index.

The Sleep category of Health Index 155 is designed to help users monitor their sleep patterns and the quality of their sleep. It is intended to help users learn about the importance of sleep in their healthy lifestyle and the relationship of sleep to circadian rhythms, being the normal daily variations in body functions. The Sleep category is based upon both data input by  
30 the user and data sensed by sensor device 10. The data input by the user for each relevant time interval includes the times the user went to sleep and woke up and a rating of the quality of sleep. As noted in Table 2, the data from sensor device 10 that is relevant includes skin temperature,

heat flow, beat-to-beat heart variability, heart rate, pulse rate, respiration rate, core temperature, galvanic skin response, EMG, EEG, EOG, blood pressure, and oxygen consumption. Also relevant is ambient sound and body movement or motion as detected by a device such as an accelerometer. This data can then be used to calculate or derive sleep onset and wake time, sleep  
5 interruptions, and the quality and depth of sleep.

The Sleep Health Index piston level is determined with respect to a healthy daily routine including getting a minimum amount, preferably eight hours, of sleep each night and having a predictable bed time and wake time. The specific parameters which determine the piston level calculation include the number of hours of sleep per night and the bed time and wake time as  
10 sensed by sensor device 10 or as input by the user, and the quality of the sleep as rated by the user or derived from other data.

Information regarding sleep is presented to the user through sleep web page 290 shown in Fig. 9. Sleep web page 290 includes a sleep duration indicator 295, based on either data from sensor device 10 or on data input by the user, together with user sleep time indicator 300 and  
15 wake time indicator 305. A quality of sleep rating 310 input by the user may also be utilized and displayed. If more than a one day time interval is being displayed on sleep web page 290, then sleep duration indicator 295 is calculated and displayed as a cumulative value, and sleep time indicator 300, wake time indicator 305 and quality of sleep rating 310 are calculated and illustrated as averages. Sleep web page 290 also includes a user-selectable sleep graph 315  
20 which calculates and displays one sleep related parameter over a pre-selected time interval. For illustrative purposes, Fig. 9 shows heat flow over a one-day period, which tends to be lower during sleeping hours and higher during waking hours. From this information, a person's bio-rhythms can be derived. Sleep graph 315 may also include a graphical representation of data from an accelerometer incorporated in sensor device 10 which monitors the movement of the  
25 body. The sleep web page 290 may also include hyperlinks 320 which allow the user to directly access sleep related news items and articles, suggestions for refining or improving daily routine with respect to sleep and affiliate advertising available elsewhere on the network, and a sleep calendar 325 for choosing a relevant time interval. The items shown at 320 may be selected and customized based on information learned about the individual in the survey and on their  
30 performance as measured by the Health Index.

The Activities of Daily Living category of Health Index 155 is designed to help users monitor certain health and safety related activities and risks and is based entirely on data input by

the user. The Activities of Daily Living category is divided into four sub-categories: personal hygiene, which allows the user to monitor activities such as brushing and flossing his or her teeth and showering; health maintenance, that tracks whether the user is taking prescribed medication or supplements and allows the user to monitor tobacco and alcohol consumption and automobile safety such as seat belt use; personal time, that allows the user to monitor time spent socially with family and friends, leisure, and mind centering activities; and responsibilities, that allows the user to monitor certain work and financial activities such as paying bills and household chores.

The Activities of Daily Living Health Index piston level is preferably determined with respect to the healthy daily routine described below. With respect to personal hygiene, the routine requires that the users shower or bathe each day, brush and floss teeth each day, and maintain regular bowel habits. With respect to health maintenance, the routine requires that the user take medications and vitamins and/or supplements, use a seat belt, refrain from smoking, drink moderately, and monitor health each day with the Health Manager. With respect to personal time, the routine requires the users to spend at least one hour of quality time each day with family and/or friends, restrict work time to a maximum of nine hours a day, spend some time on a leisure or play activity each day, and engage in a mind stimulating activity. With respect to responsibilities, the routine requires the users to do household chores, pay bills, be on time for work, and keep appointments. The piston level is calculated based on the degree to which the user completes a list of daily activities as determined by information input by the user.

Information relating to these activities is presented to the user through daily activities web page 330 shown in Fig. 10. In preferred daily activities web page 330, activities chart 335, selectable for one or more of the sub-categories, shows whether the user has done what is required by the daily routine. A colored or shaded box indicates that the user has done the required activity, and an empty, non-colored or shaded box indicates that the user has not done the activity. Activities chart 335 can be created and viewed in selectable time intervals. For illustrative purposes, Fig. 10 shows the personal hygiene and personal time sub-categories for a particular week. In addition, daily activities web page 330 may include daily activity hyperlinks 340 which allow the user to directly access relevant news items and articles, suggestions for improving or refining daily routine with respect to activities of daily living and affiliate advertising, and a daily activities calendar 345 for selecting a relevant time interval. The items

shown at 340 may be selected and customized based on information learned about the individual in the survey and on their performance as measured by the Health Index.

The How You Feel category of Health Index 155 is designed to allow users to monitor their perception of how they felt on a particular day, and is based on information, essentially a subjective rating, that is input directly by the user. A user provides a rating, preferably on a scale of 1 to 5, with respect to the following nine subject areas: mental sharpness; emotional and psychological well being; energy level; ability to cope with life stresses; appearance; physical well being; self-control; motivation; and comfort in relating to others. Those ratings are averaged and used to calculate the relevant piston level.

Referring to Fig. 11, Health Index web page 350 is shown. Health Index web page 350 enables users to view the performance of their Health Index over a user selectable time interval including any number of consecutive or non-consecutive days. Using Health Index selector buttons 360, the user can select to view the Health Index piston levels for one category, or can view a side-by-side comparison of the Health Index piston levels for two or more categories. For example, a user might want to just turn on Sleep to see if their overall sleep rating improved over the previous month, much in the same way they view the performance of their favorite stock. Alternatively, Sleep and Activity Level might be simultaneously displayed in order to compare and evaluate Sleep ratings with corresponding Activity Level ratings to determine if any day-to-day correlations exist. Nutrition ratings might be displayed with How You Feel for a pre-selected time interval to determine if any correlation exists between daily eating habits and how they felt during that interval. For illustrative purposes, Fig. 11 illustrates a comparison of Sleep and Activity Level piston levels for the week of June 10 through June 16. Health Index web page 350 also includes tracking calculator 365 that displays access information and statistics such as the total number of days the user has logged in and used the Health Manager, the percentage of days the user has used the Health Manager since becoming a subscriber, and percentage of time the user has used the sensor device 10 to gather data.

Referring again to Fig. 5, opening Health Manager web page 150 may include a plurality of user selectable category summaries 156a through 156f, one corresponding to each of the Health Index 155 categories. Each category summary 156a through 156f presents a pre-selected filtered subset of the data associated with the corresponding category. Nutrition category summary 156a displays daily target and actual caloric intake. Activity Level category summary 156b displays daily target and actual calories burned. Mind Centering category summary 156c

displays target and actual depth of mind centering or focus. Sleep category summary 156d displays target sleep, actual sleep, and a sleep quality rating. Daily Activities category summary 156e displays a target and actual score based on the percentage of suggested daily activities that are completed. The How You Feel category summary 156f shows a target and actual rating for the day.

Opening Health Manager web page 150 also may include Daily Dose section 157 which provides, on a daily time interval basis, information to the user, including, but not limited to, hyperlinks to news items and articles, commentary and reminders to the user based on tendencies, such as poor nutritional habits, determined from the initial survey. The commentary for Daily Dose 157 may, for example, be a factual statement that drinking 8 glasses of water a day can reduce the risk of colon cancer by as much as 32%, accompanied by a suggestion to keep a cup of water by your computer or on your desk at work and refill often. Opening Health Manager web page 150 also may include a Problem Solver section 158 that actively evaluates the user's performance in each of the categories of Health Index 155 and presents suggestions for improvement. For example, if the system detects that a user's Sleep levels have been low, which suggest that the user has been having trouble sleeping, Problem Solver 158 can provide suggestions for way to improve sleep. Problem Solver 158 also may include the capability of user questions regarding improvements in performance. Opening Health Manager web page 150 may also include a Daily Data section 159 that launches an input dialog box. The input dialog box facilitates input by the user of the various data required by the Health Manager. As is known in the art, data entry may be in the form of selection from pre-defined lists or general free form text input. Finally, opening Health Manager web page 150 may include Body Stats section 161 which may provide information regarding the user's height, weight, body measurements, body mass index or BMI, and vital signs such as heart rate, blood pressure or any of the identified physiological parameters.

The terms and expressions which have been employed herein are used as terms of description and not as limitation, and there is no intention in the use of such terms and expressions of excluding equivalents of the features shown and described or portions thereof, it being recognized that various modifications are possible within the scope of the invention claimed. Although particular embodiments of the present invention have been illustrated in the foregoing detailed description, it is to be further understood that the present invention is not to be

limited to just the embodiments disclosed, but that they are capable of numerous rearrangements, modifications and substitutions.

**THE CLAIMS**

WHAT IS CLAIMED IS:

- 5           1.       A system for detecting, monitoring and reporting human physiological information, comprising:
- a sensor device which generates, when placed in proximity with at least a portion of the human body, at least one of data indicative of one or more physiological parameters of an individual and derived data from at least a portion of
- 10       said data indicative of one or more physiological parameters;
- a central monitoring unit remote from said sensor device adapted for the generation of analytical status data from at least a portion of at least one of said data indicative of one or more physiological parameters, said derived data and said analytical status data, said central monitoring unit including a data storage device for
- 15       retrievably storing at least one of said data indicative of one or more physiological parameters, said derived data and said analytical status data;
- data transfer means for establishing at least temporary electronic communication between said sensor device and said central monitoring unit; and
- means for transmitting at least one of said data indicative of one or more
- 20       physiological parameters, said derived data and said analytical status data to a recipient.
2.       A system according to claim 1, wherein said sensor device comprises one or more sensors for generating signals in response to physiological characteristics of said
- 25       individual.
3.       A system according to claim 2, wherein said signals comprise said data indicative of one or more physiological parameters of said individual.
4.       A system according to claim 2, wherein said sensor device further comprises a
- 30       processor coupled to said sensors, said processor being programmed to generate said data

indicative of one or more physiological parameters of said individual from said signals generated by said one or more sensors.

5           5.       A system according to claim 4, wherein said processor is further programmed to generate said derived data.

          6.       A system according to claim 5, wherein said sensor device provides feedback to said individual based on said derived data.

10           7.       A system according to claim 4, wherein said central monitoring unit is adapted to generate derived data from at least a portion of said data indicative of one or more physiological parameters of said individual.

          8.       A system according to claim 4, wherein said processor generates said data  
15   indicative of one or more physiological parameters by accumulating said signals generated by said sensors.

          9.       A system according to claim 8, wherein said data indicative of one or more physiological parameters comprises a summary over a period of time.

20           10.      A system according to claim 4, wherein said sensor device further comprises a memory for storing said data indicative of one or more physiological parameters and said derived data.

25           11.      A system according to claim 1, wherein said central monitoring unit is adapted to generate one or more web pages containing at least one of said data indicative of one or more physiological parameters, said derived data, and said analytical status data, and wherein said means for transmitting makes said web pages accessible by said recipient over the Internet.

30           12.      A system according to claim 7, wherein said central monitoring unit is adapted to generate one or more web pages containing at least one of said data indicative of one or

more physiological parameters, said derived data, and said analytical status data, and wherein said means for transmitting makes said web pages accessible by said recipient over the Internet.

5           13.     A system according to claim 11, further comprising a personal computer having web browsing software, said recipient accessing said web pages using said personal computer.

10           14.     A system according to claim 1, wherein said means for transmitting transmits said at least one of said data indicative of one or more physiological parameters, said derived data, and said analytical status data to said recipient over an electronic network.

15           15.     A system according to claim 14, further comprising a personal digital assistant for receiving said at least one of said data indicative of one or more physiological parameters, said derived data, and said analytical status data.

20           16.     A system according to claim 14, further comprising a pager for receiving said at least one of said data indicative of one or more physiological parameters, said derived data, and said analytical status data.

            17.     A system according to claim 14, further comprising a cellular phone for receiving said at least one of said data indicative of one or more physiological parameters, said derived data, and said analytical status data.

25           18.     A system according to claim 1, wherein said means for transmitting transmits said at least one of said data indicative of one or more physiological parameters, said derived data, and said analytical status data to said recipient in physical form.

30           19.     A system according to claim 18, wherein said physical form comprises a facsimile message.

20. A system according to claim 18, wherein said physical form comprises a piece of physical mail.

21. A system according to claim 1, wherein said recipient comprises said individual.

22. A system according to claim 1, wherein said recipient comprises a third party authorized by said individual.

23. A system according to claim 1, further comprising means for obtaining life activities data of said individual, said life activities data being retrievably stored in said data storage device, wherein said analytical status data is also generated from selected portions of said life activities data.

24. A system according to claim 23, said means for obtaining comprising means for enabling said individual to input said life activities data and transmit said life activities data to said central monitoring unit.

25. A system according to claim 23, said means for obtaining comprising an input device for enabling said individual to input said life activities data, said input device being adapted to transmit said life activities data to said central monitoring unit.

26. A system according to claim 1, wherein said sensor device generates data indicative of one or more contextual parameters associated with said individual, and wherein said analytical status data is also generated from selected portions of said data indicative of one or more contextual parameters.

27. A system according to claim 26, wherein said sensor device comprises one or more sensors for generating signals in response to one or more contextual characteristics.

30

28. A system according to claim 1, further comprising means for downloading data from said central monitoring unit to said sensor device.

29. A method of detecting, monitoring and reporting human physiological information, comprising the steps of:

5 generating at least one of data indicative of one or more physiological parameters of an individual and derived data from at least a portion of said data indicative of one or more physiological parameters using a sensor device adapted to be placed in proximity with at least a portion of the human body;

10 transmitting said at least one of said data indicative of one or more physiological parameters and said derived data to a central monitoring unit remote from said sensor device;

retrievably storing said at least one of said data indicative of one or more physiological parameters and said derived data in a storage device;

15 generating analytical status data from at least a portion of at least one of said data indicative of one or more physiological parameters, said derived data and said analytical status data; and

transmitting to a recipient at least one of said data indicative of one or more physiological parameters, said derived data and said analytical status data.

30. A method according to claim 29, further comprising generating with one or  
20 more sensors signals in response to physiological characteristics of said individual.

31. A method according to claim 30, wherein said signals comprise said data indicative of one or more physiological parameters of said individual.

25 32. A method according to claim 30, wherein said data indicative of one or more physiological parameters of said individual is generated from said signals generated by said one or more sensors.

30 33. A method according to claim 29, further comprising generating at said central monitoring unit derived data from at least a portion of said data indicative of one or more physiological parameters.

34. A method according to claim 32, further comprising accumulating said signals generated by said sensors.

35. A method according to claim 34, wherein said data indicative of one or more physiological parameters comprises a summary over a period of time.

36. A method according to claim 29, further comprising storing said data indicative of said one or more physiological parameters in a memory prior to said transmitting step.

10

37. A method according to claim 29, wherein said at least one of said data indicative of one or more physiological parameters, said derived data and said analytical status data are transmitted to said recipient over an electronic network.

38. A method according to claim 37, wherein said at least one of said data indicative of one or more physiological parameters, said derived data and said analytical status data are embodied in one or more web pages generated by said central monitoring unit.

15

39. A method according to claim 29, wherein said at least one of said data indicative of one or more physiological parameters, said derived data and said analytical status data are transmitted to said recipient in physical form.

20

40. A method according to claim 39, wherein said physical form comprises a facsimile message.

25

41. A method according to claim 39, wherein said physical form comprises physical mail.

42. A method according to claim 29, wherein said recipient comprises said individual.

30

43. A method according to claim 29, wherein said recipient comprises a third party authorized by said individual.

44. A method according to claim 29, wherein said analytical status data is also  
5 generated from life activities data of said individual.

45. A method according to claim 44, wherein said life activities data is input by said individual and transmitted to said central monitoring unit.

10 46. A method according to claim 45, further comprising storing said life activities data in said data storage device.

47. A method according to claim 29, further comprising generating data indicative of one or more contextual parameters of said individual, wherein said analytical status data is  
15 also generated from at least a portion of said data indicative of one or more contextual parameters.

48. A system for detecting and reporting one or more contextual parameters, comprising:  
20 a sensor device which generates data indicative of one or more contextual parameters associated with an individual when placed in proximity with at least a portion of the human body;  
means for transmitting said data from said sensor device to a central monitoring unit remote from said sensor device, said central monitoring unit including  
25 a storage device for retrievably storing said data, and said central monitoring unit being adapted to generate analytical status data based on selected portions of said data retrieved from said storage device; and  
means for transmitting said analytical status data to a recipient.

30 49. A system according to claim 48, wherein said sensor device comprises one or more sensors for generating signals in response to one or more contextual characteristics.

50. A system according to claim 49, wherein said signals comprise said data indicative of one or more contextual parameters associated with said individual.

51. A system according to claim 49, wherein said sensor device further comprises  
5 a processor coupled to said sensors, said processor being programmed to generate said data indicative of one or more contextual parameters based upon said signals generated by said one or more sensors.

52. A system according to claim 51, wherein said processor generates said data by  
10 accumulating said signals generated by said sensors.

53. A system according to claim 52, wherein said data comprises a summary over a period of time.

54. A system according to claim 51, wherein said sensor device further comprises  
15 a memory, and wherein said data generated by said processor is stored in said memory prior to being transmitted to said central monitoring unit.

55. A system according to claim 48, wherein said central monitoring unit is  
20 adapted to generate one or more web pages containing said analytical status data, and wherein said means for transmitting makes said web pages accessible by said recipient over the Internet.

56. A system according to claim 55, further comprising a personal computer  
25 having web browsing software, said recipient accessing said web pages using said personal computer.

57. A system according to claim 48, wherein said means for transmitting transmits  
said analytical status data to said recipient over an electronic network.

30

58. A system according to claim 48, wherein said means for transmitting transmits  
said analytical status data to said recipient in physical form.

59. A system according to claim 48, further comprising means for obtaining life activities data of said individual, said life activities data being retrievably stored in said storage device, wherein said analytical status data is also generated from at least a portion of said life activities data.

60. A system according to claim 59, said means for obtaining comprising means for enabling said individual to input said life activities data and transmit said life activities data to said central monitoring unit.

61. A system according to claim 59, said means for obtaining comprising an input device for enabling said individual to input said life activities data, said input device being adapted to transmit said life activities data to said central monitoring unit.

62. A system for monitoring the degree to which an individual has followed a suggested routine, comprising:

a sensor device adapted to generate at least one of data indicative of one or more physiological parameters of said individual and derived data from at least a portion of said data indicative of one or more physiological parameters when placed in contact with at least a portion of the human body;

means for transmitting said at least one of said data indicative of one or more physiological parameters and said derived data from said sensor device to a central monitoring unit remote from said sensor device; and

means for providing life activities data of said individual to said central monitoring unit;

wherein said central monitoring unit is adapted to generate and provide feedback to a recipient relating to the degree to which said individual has followed said suggested routine, said feedback being generated from at least a portion of at least one of said data indicative of one or more physiological parameters of said individual, said derived data and said life activities data.

63. A system according to claim 62, wherein said sensor device comprises one or more sensors for generating signals in response to physiological characteristics of said individual.

64. A system according to claim 63, wherein said signals comprise said data  
5 indicative of one or more physiological parameters of said individual.

65. A system according to claim 63, wherein said sensor device further comprises a processor coupled to said sensors, said processor being programmed to generate said data indicative of one or more physiological parameters of said individual based upon said signals  
10 generated by said one or more sensors.

66. A system according to claim 62, said central monitoring unit including a data storage device for retrievably storing said data indicative of one or more physiological parameters of said individual, said derived data and said life activities data.  
15

67. A system according to claim 62, wherein said central monitoring unit is adapted to generate derived data from at least a portion of said data indicative of one or more physiological parameters of said individual.

68. A system according to claim 62, wherein said routine comprises a plurality of categories.  
20

69. A system according to claim 68, wherein said feedback is generated and provided with respect to each of said categories.  
25

70. A system according to claim 69, wherein said categories include two or more of nutrition, activity level, mind centering, sleep, and daily activities.

71. A system according to claim 69, wherein at least a portion of said feedback is  
30 in graphical form.

72. A system according to claim 71, wherein said central monitoring unit is adapted to generate one or more web pages containing said feedback, said web pages being accessible by said recipient over the Internet.

5 73. A system according to claim 62, wherein said central monitoring unit is adapted to generate one or more web pages containing said feedback, said web pages being accessible by said recipient over the Internet.

74. A system according to claim 67 wherein said central monitoring unit is  
10 adapted to generate one or more web pages containing said feedback, said web pages being accessible by said recipient over the Internet.

75. A system according to claim 62, further comprising means for transmitting said feedback to said recipient over an electronic network.

15 76. A system according to claim 67, further comprising means for transmitting said feedback to said recipient over an electronic network.

77. A system according to claim 71, further comprising means for transmitting said feedback to said recipient over an electronic network.

20 78. A system according to claim 62, further comprising means for transmitting said feedback to said recipient in physical form.

79. A system according to claim 67 further comprising means for transmitting said  
25 feedback to said recipient in physical form.

80. A system according to claim 71, further comprising means for transmitting said feedback to said recipient in physical form.

30 81. A system according to claim 78, wherein said central monitoring unit is adapted to generate one or more web pages for each of said categories, said one or more web pages containing detailed information based on at least a portion of at least one of said data

indicative of one or more physiological parameters of said individual, said derived data, and said life activities data.

82. A system according to claim 62, said means for providing comprising means  
5 for enabling said individual to input said life activities data and transmit said life activities data to said central monitoring unit.

83. A system according to claim 62, said means for providing comprising an input  
device for enabling said individual to input said life activities data, said input device being  
10 adapted to transmit said life activities data to said central monitoring unit.

84. A system according to claim 62, wherein said recipient is said individual.

85. A system according to claim 62, wherein said recipient is a third party  
15 authorized by said individual.

86. A method of monitoring the degree to which an individual has followed a suggested routine, comprising the steps of:

receiving, at a central monitoring unit, at least one of data indicative of one or  
20 more physiological parameters of said individual and derived data based on at least a portion of said data indicative of one or more physiological parameters, said data indicative of one or more physiological parameters and said derived data being generated by a sensor device when placed in proximity with at least a portion of the human body;

25 receiving at said central monitoring unit life activities data of said individual;  
generating at said central monitoring unit feedback relating to the degree to which said individual has followed said suggested routine, said feedback being generated from at least a portion of at least one of said data indicative of one or more physiological parameters of said individual, said derived data, and said life activities  
30 data; and

providing said feedback to a recipient.

87. A method according to claim 86, further comprising the step of generating at said central monitoring unit derived data from at least a portion of said data indicative of one or more physiological parameters of said individual.

5 88. A method according to claim 86, wherein said routine comprises a plurality of categories.

89. A method according to claim 88, wherein said feedback is generated with respect to each of said categories.

10

90. A method according to claim 89, wherein said categories include two or more of nutrition, activity level, mind centering, sleep, and daily activities.

91. A method according to claim 89, wherein said providing step comprises  
15 providing at least a portion of said feedback in graphical form.

92. A method according to claim 91, further comprising the step of generating at said central monitoring unit one or more web pages containing said feedback, wherein said providing step further comprises making said one or more web pages accessible to said  
20 recipient over the Internet.

93. A method according to claim 86, further comprising the step of generating at said central monitoring unit one or more web pages containing said feedback, wherein said providing step further comprises making said one or more web pages accessible to said  
25 recipient over the Internet.

94. A method according to claim 87, further comprising the step of generating at said central monitoring unit one or more web pages containing said feedback, wherein said providing step further comprises making said one or more web pages accessible to said  
30 recipient over the Internet.

95. A method according to claim 86, wherein said providing step comprises providing said feedback to said recipient over an electronic network.

96. A method according to claim 87, wherein said providing step comprises providing said feedback to said recipient over an electronic network.

97. A method according to claim 91, wherein said providing step comprises providing said feedback to said recipient over an electronic network.

98. A method according to claim 86, wherein said providing step comprises providing said feedback to said recipient in physical form.

99. A method according to claim 87, wherein said providing step comprises providing said feedback to said recipient in physical form.

100. A method according to claim 91, wherein said providing step comprises providing said feedback to said recipient in physical form.

101. A method according to claim 86, wherein said life activities data is input into an input device by said individual, and wherein said input device is adapted to transmit said life activities data to said central monitoring unit.

102. A method according to claim 86, wherein said recipient is said individual.

103. A method according to claim 86, wherein said recipient is a third party authorized by said individual.

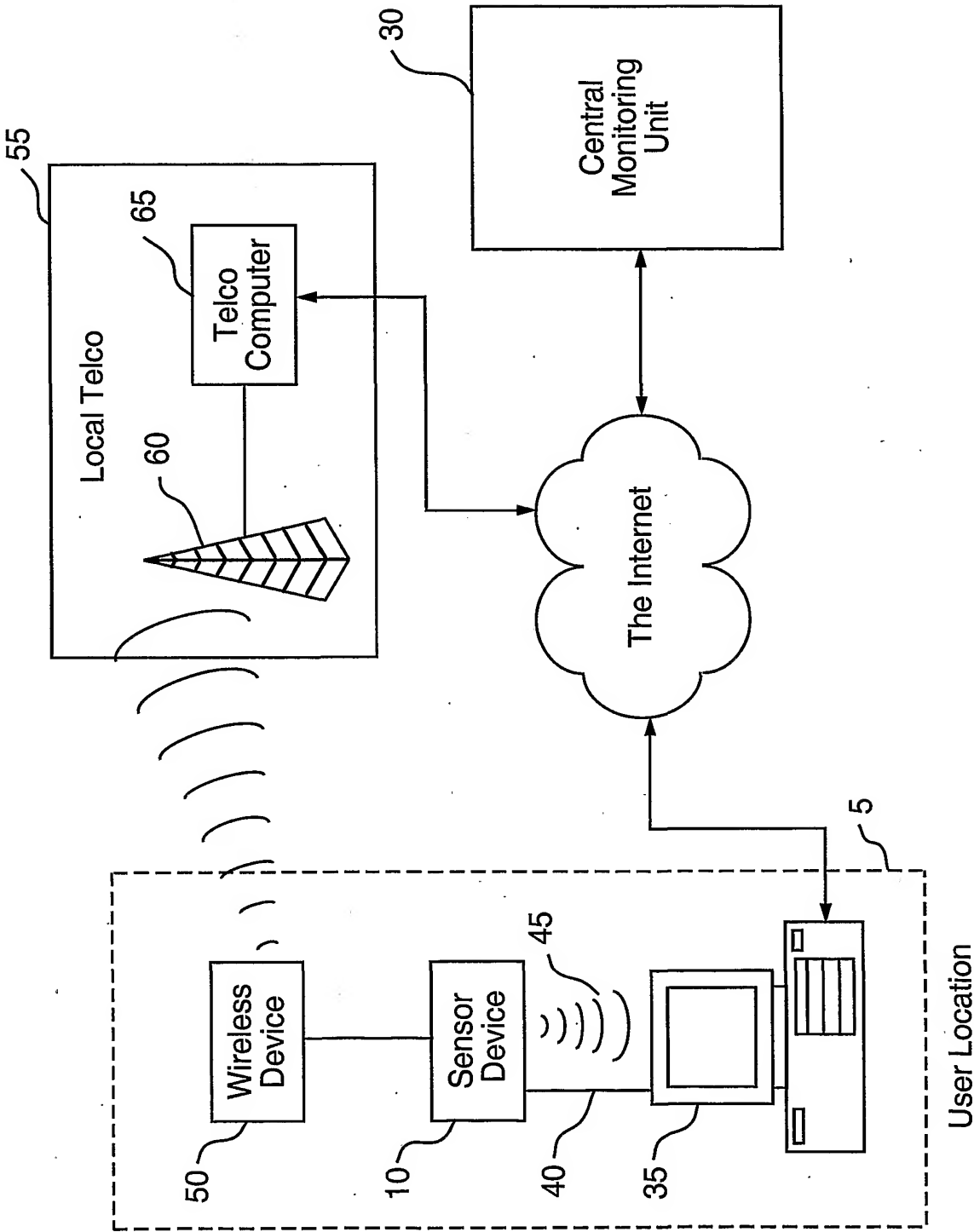


FIG. 1

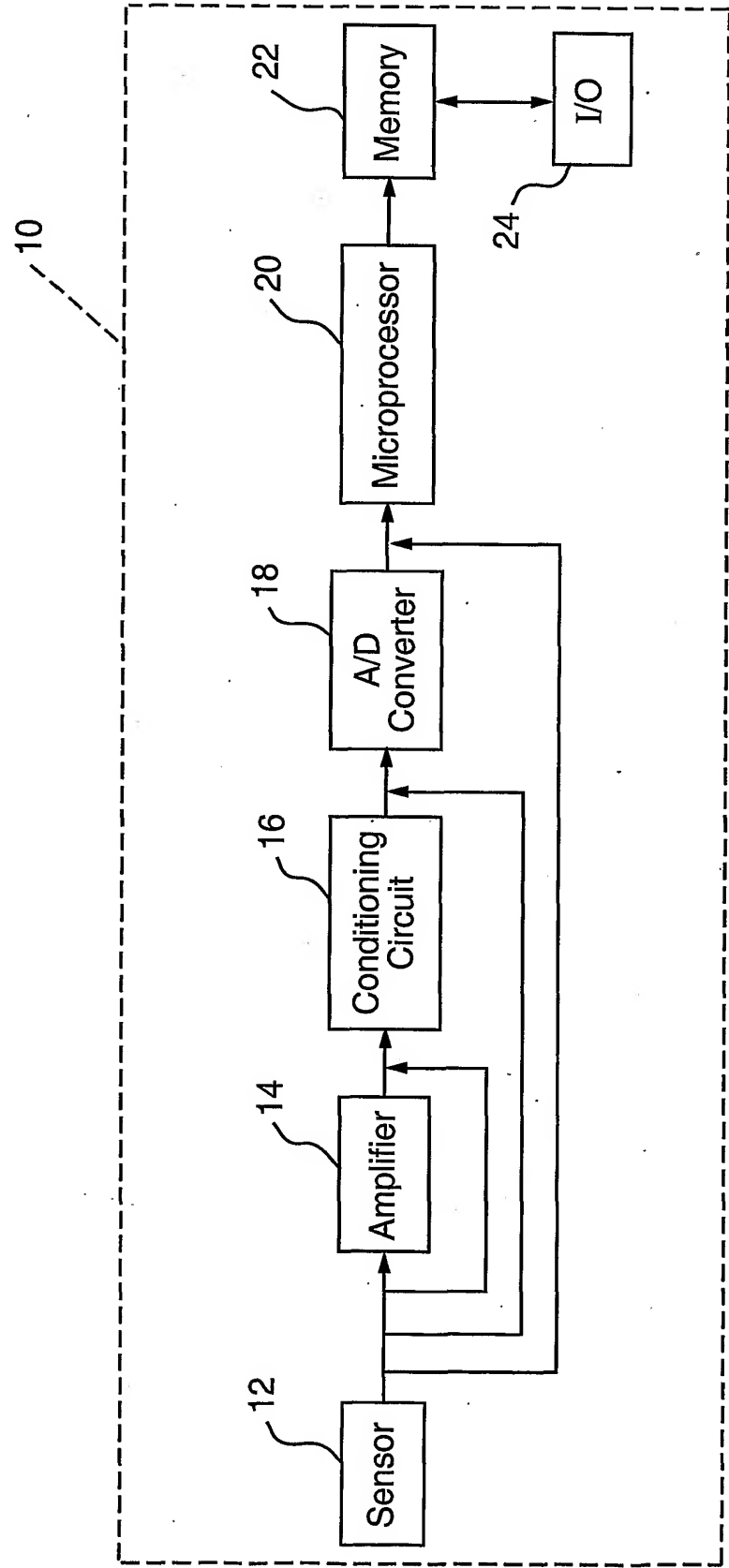


FIG. 2

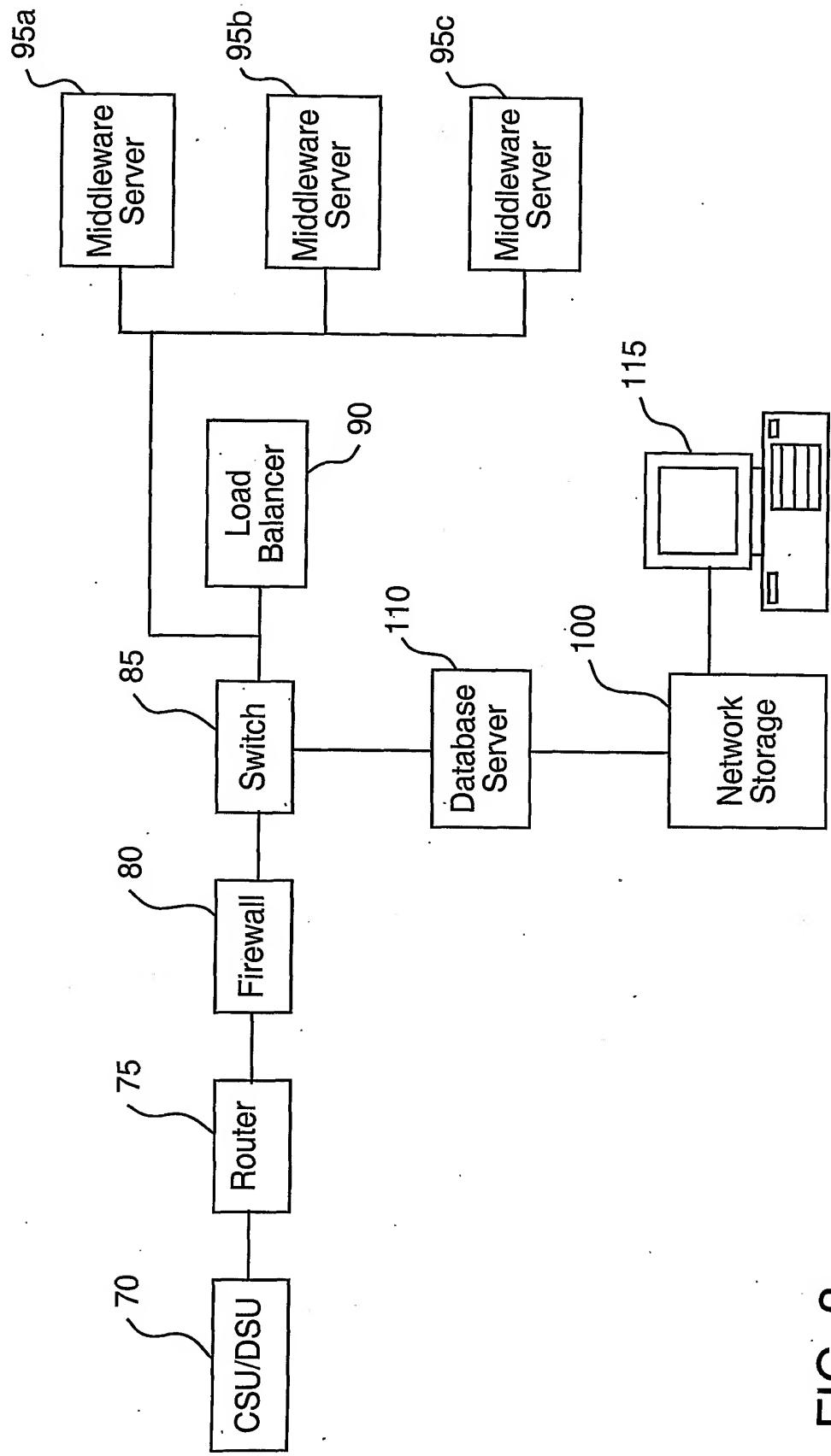


FIG. 3

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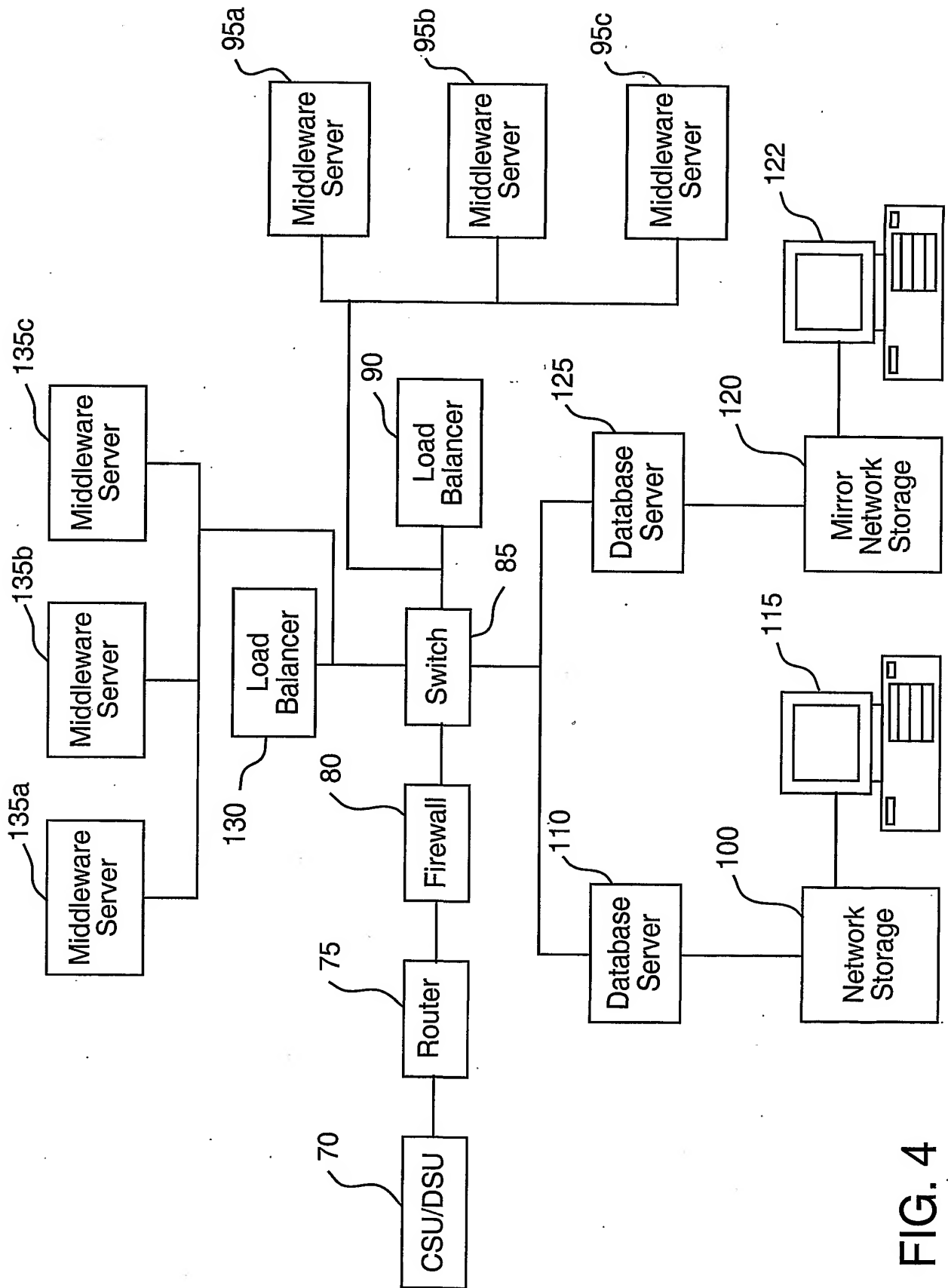


FIG. 4

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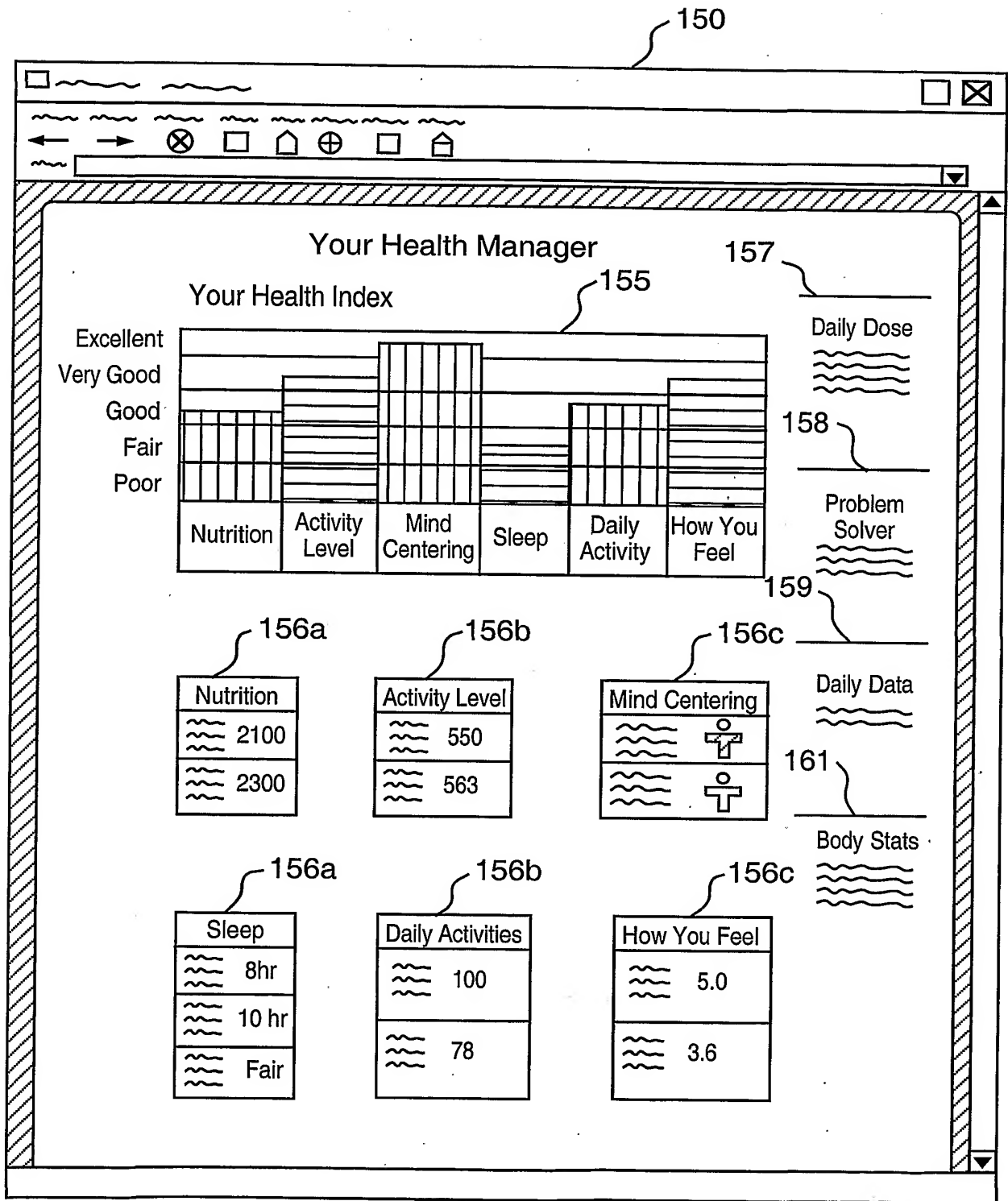


FIG. 5

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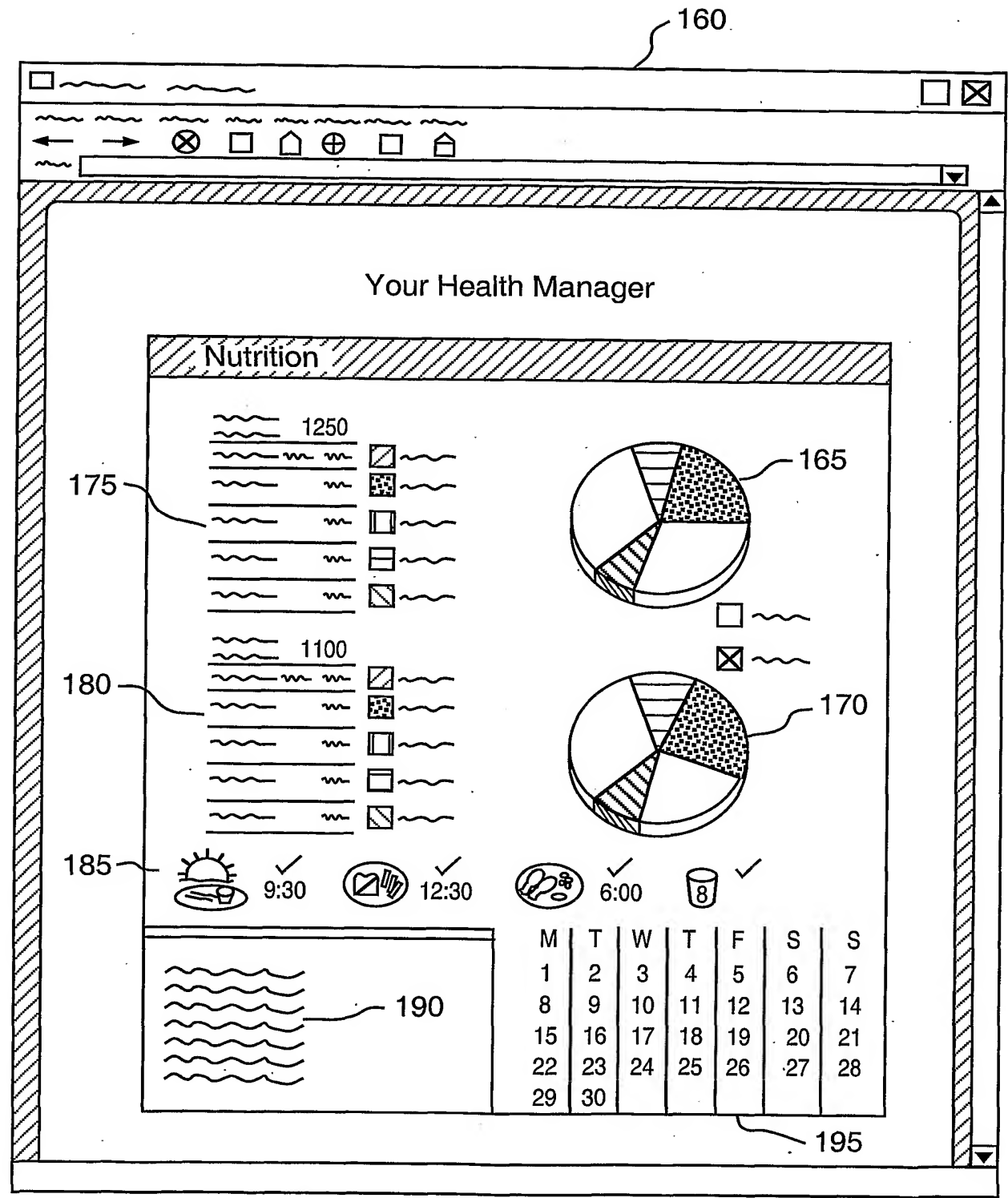


FIG. 6

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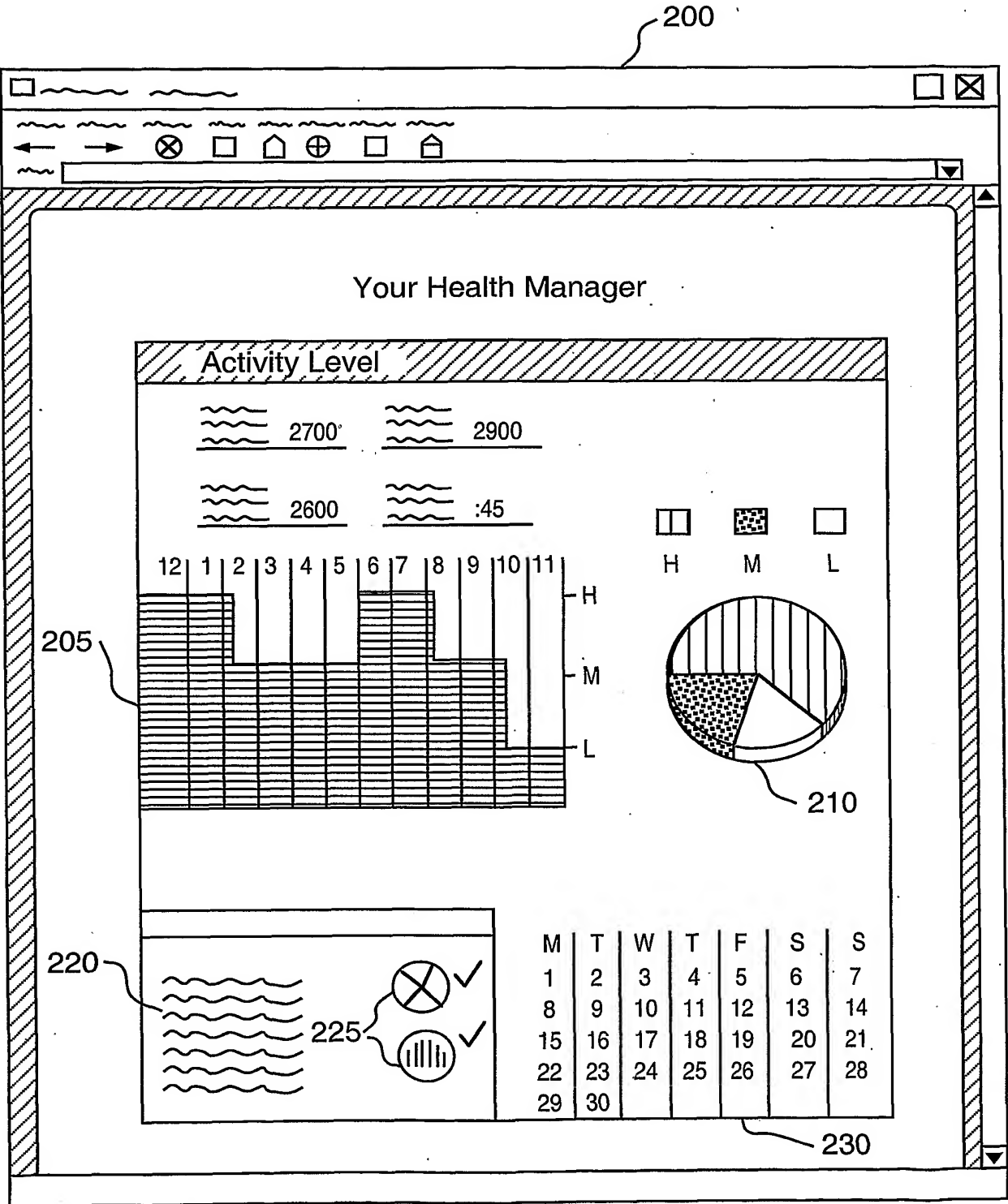


FIG. 7

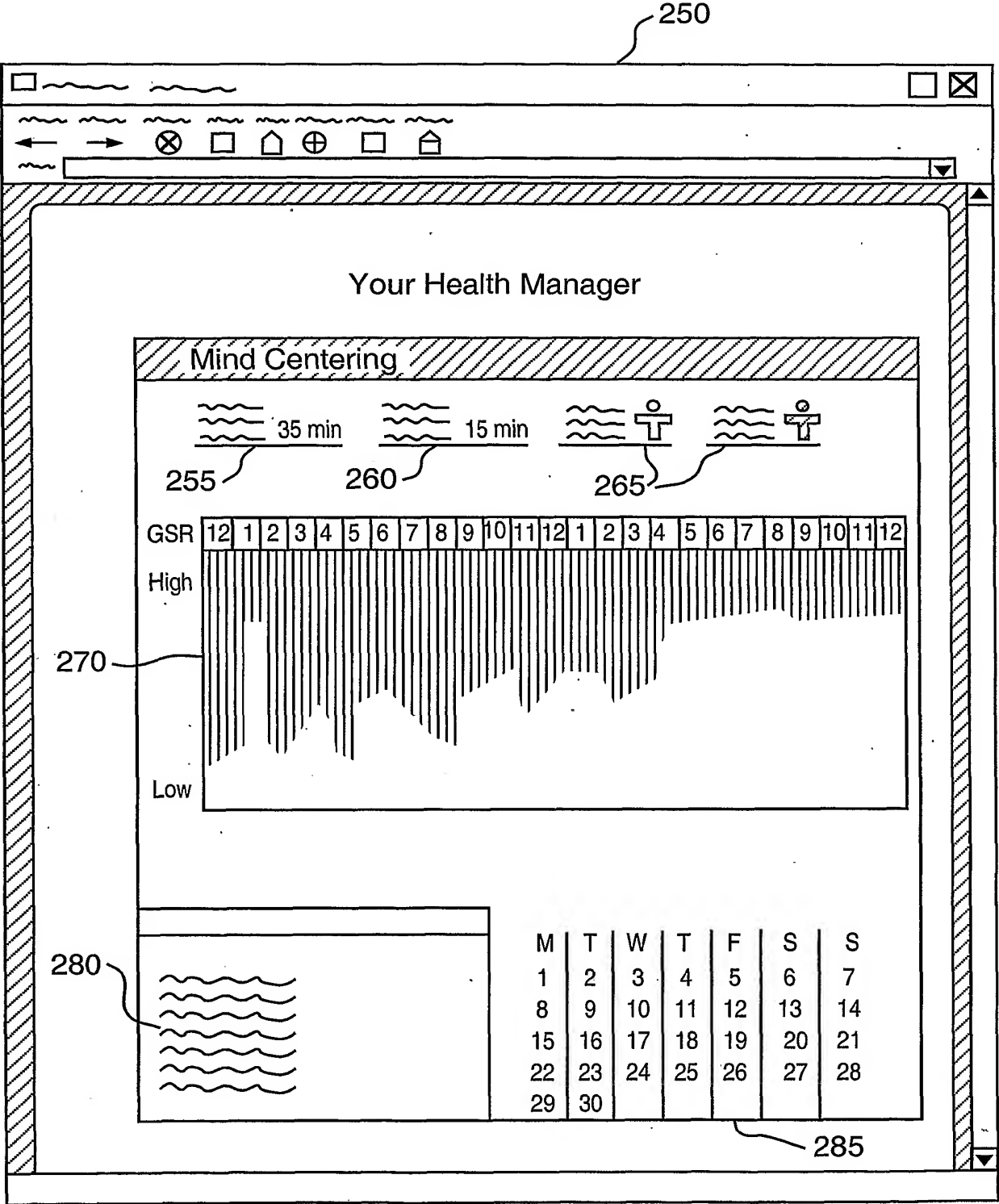


FIG. 8

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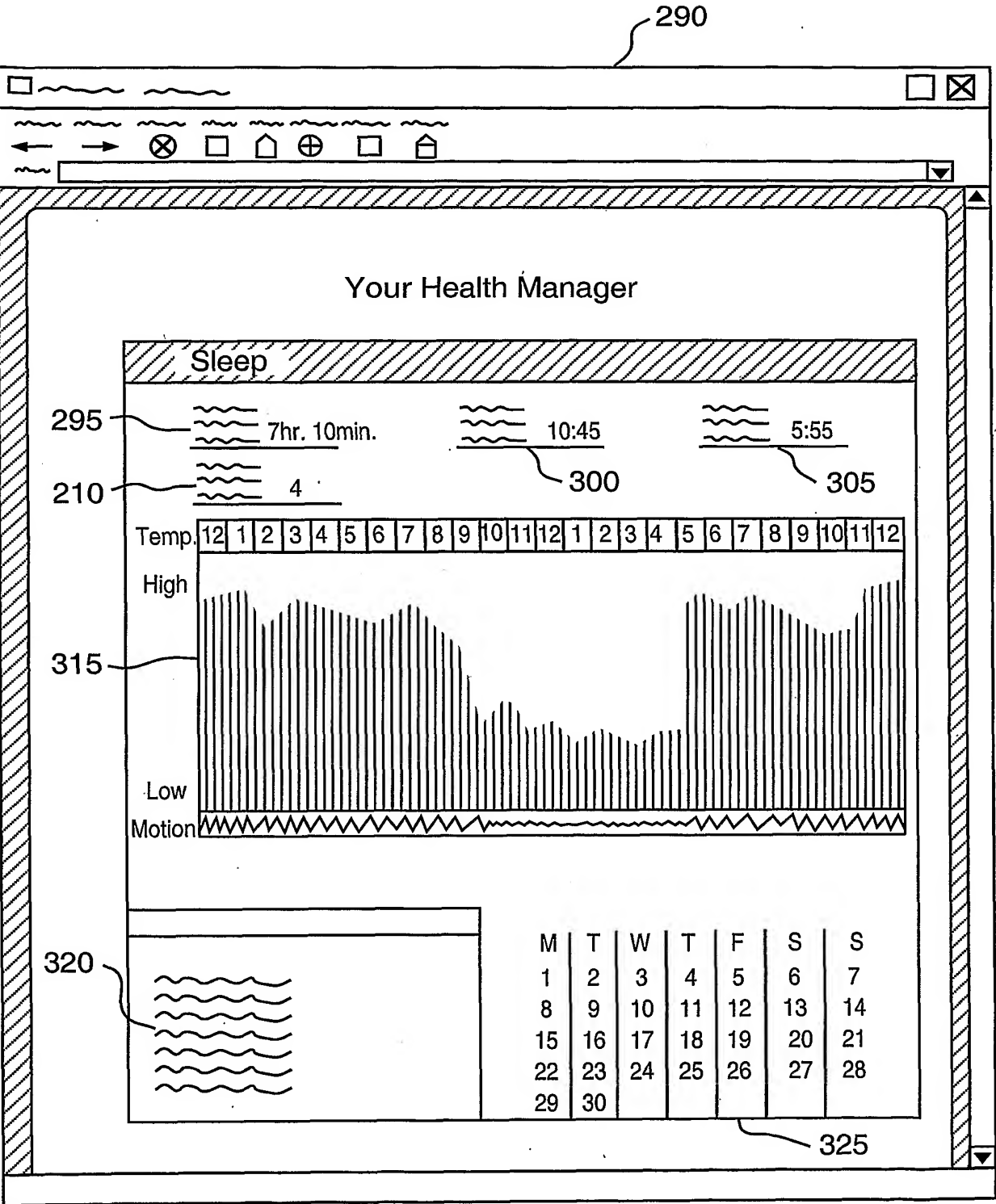


FIG. 9

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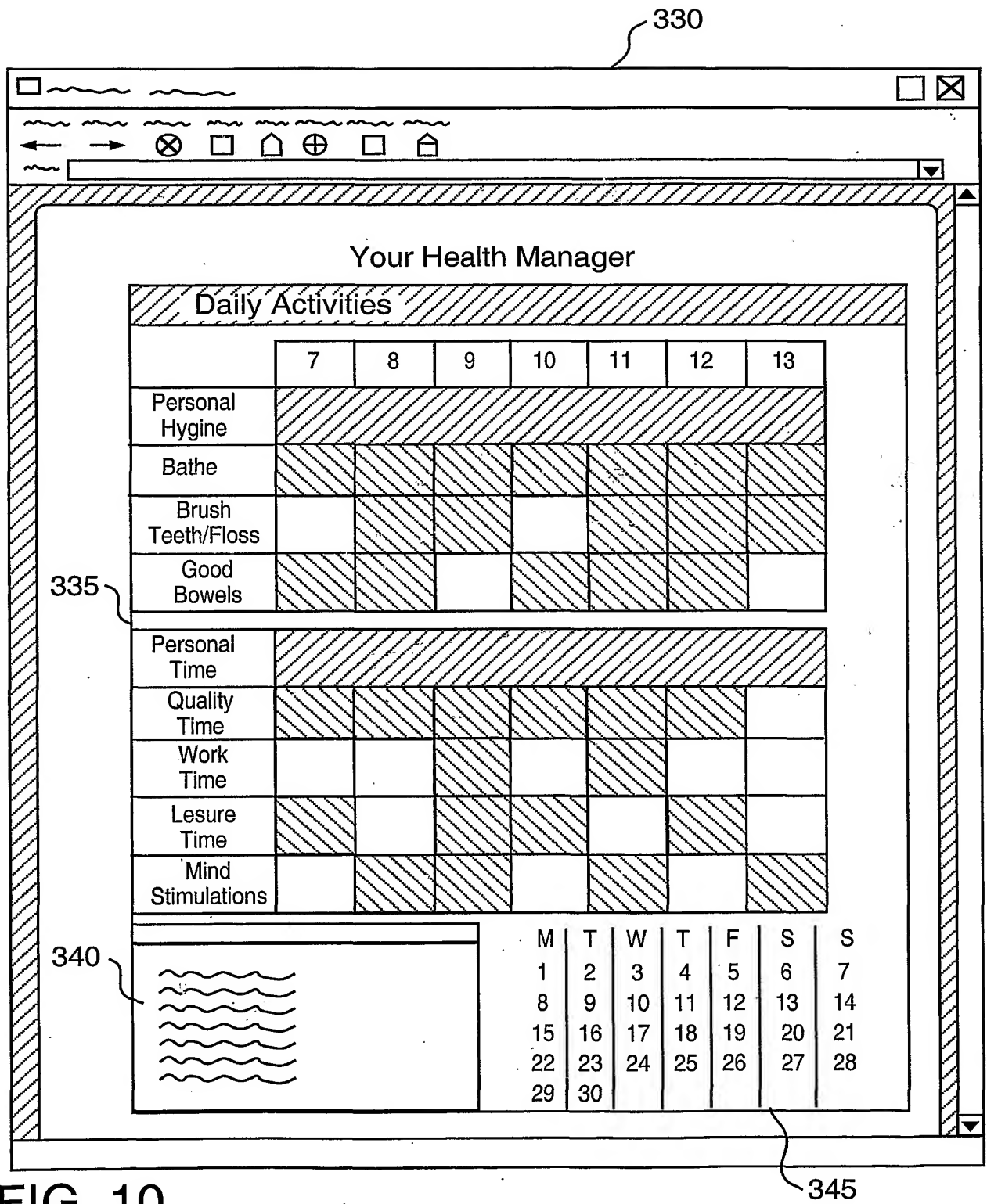


FIG. 10

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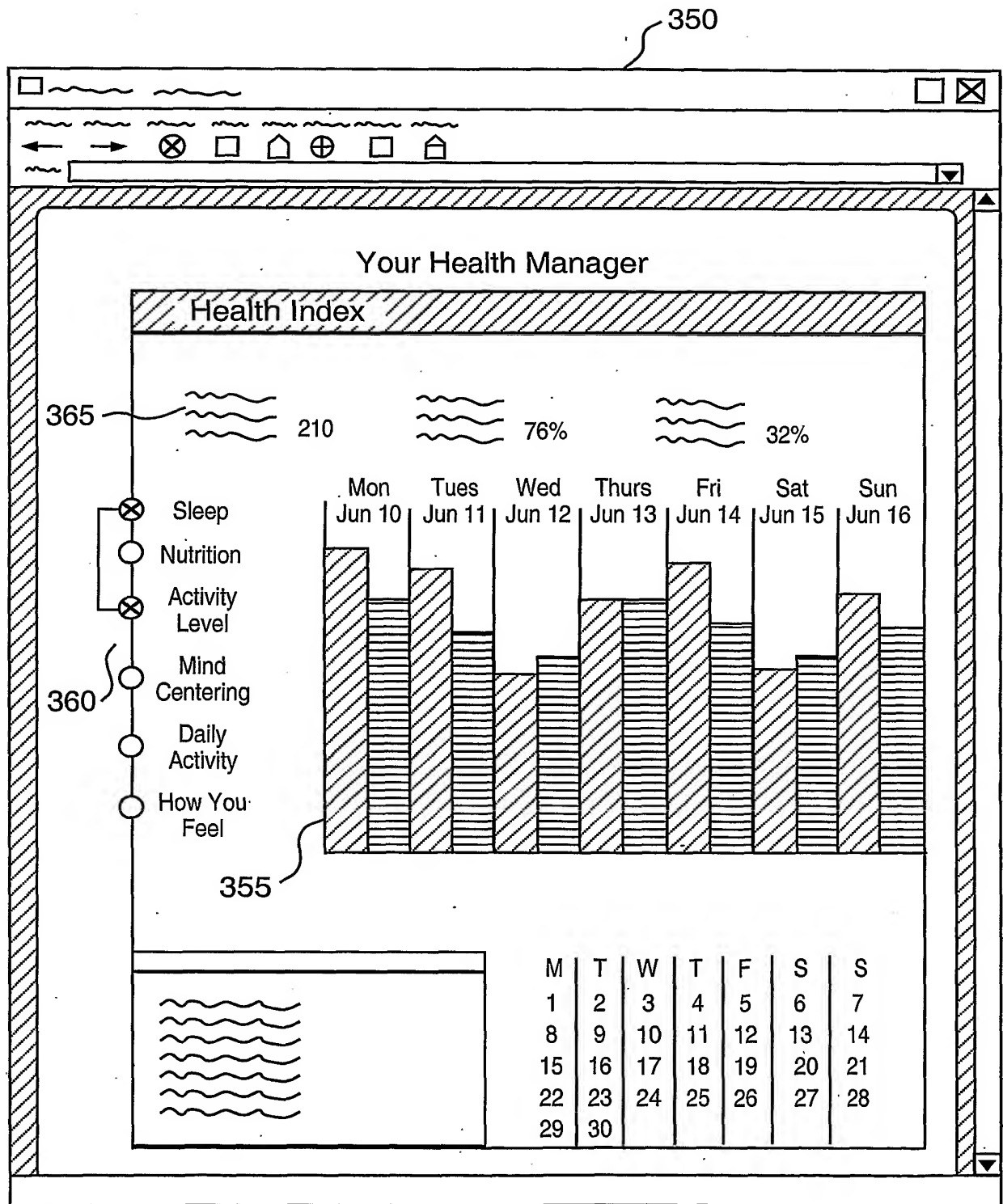


FIG. 11